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MISSOURI BOTANICAL GARDEN BULLETIN

VOLUME XXIX

WITH 65 PLATES AND
29 TEXT-FIGURES

1941

ST. LOUIS, MISSOURI

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MISSOURI BOTANICAL GARDEN BULLETIN

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OF THE MISSOURI BOTANICAL GARDEN

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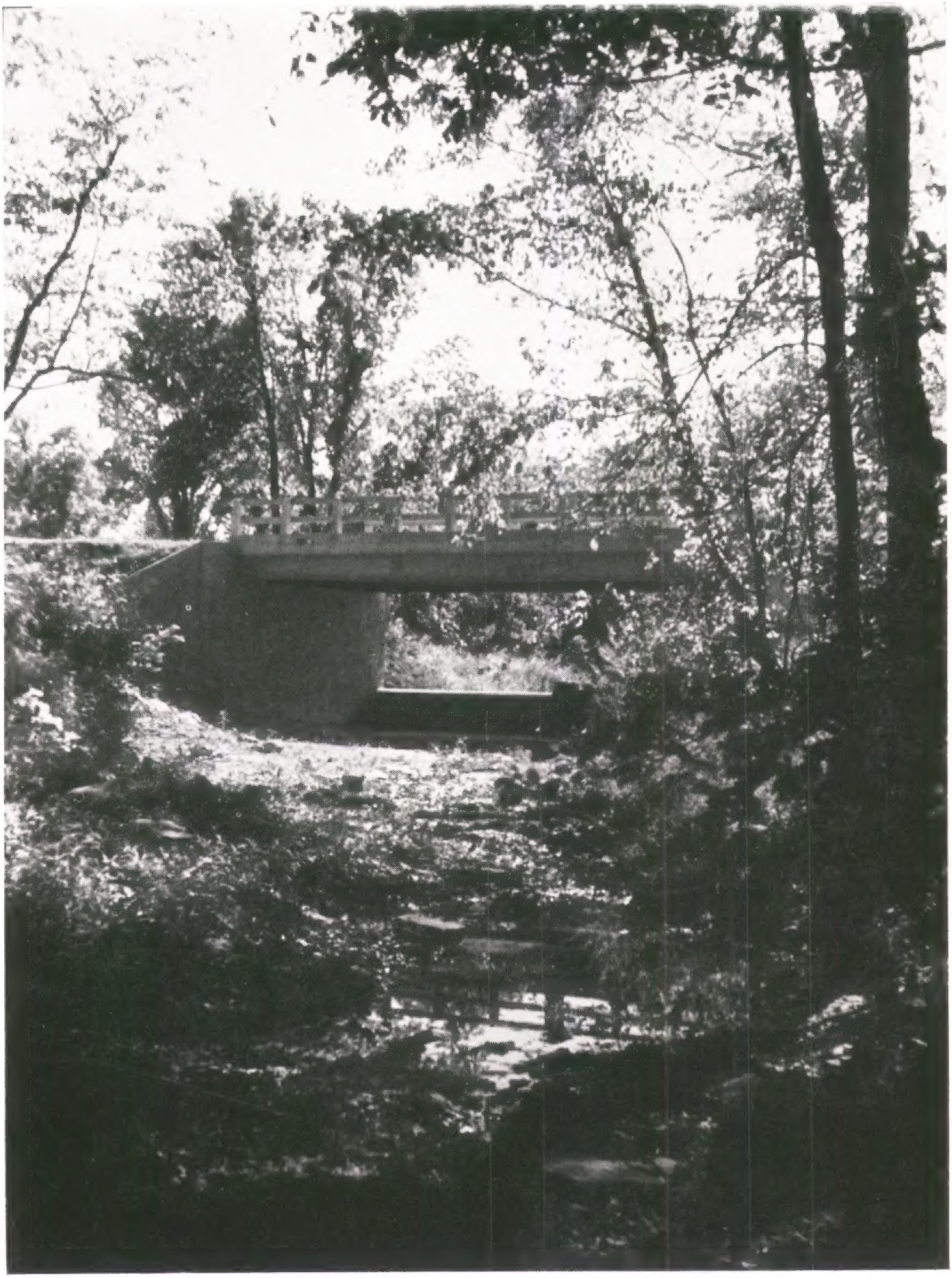
SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date to the death of Mr. Shaw, in 1889, the Garden was maintained under the personal direction of its founder, and while virtually a private garden it was, except at certain stated times, always open to the public. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was designated by Mr. Shaw as its official title and in his will and all of his writings he specifically referred to it as the "Missouri Botanical Garden." By a provision of Mr. Shaw's will the Garden passed at his death into the hands of a Board of Trustees. The original members of the Board were designated in the will, and the Board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provison of the will, the immediate direction of the Garden is vested in a Director, appointed by the Board of Trustees. The Garden receives no income from city or state, but is supported entirely from funds left by the founder.

The city Garden comprises 75 acres, where about 12,000 species of plants are growing. There is now in process of development a tract of land of over 1,600 acres outside the city limits which is to be devoted to (1) the propagation and growing of plants, trees, and shrubs, designed for showing either indoors or outside, at the city Garden, thus avoiding the existing difficulties of growing plants in the city atmosphere; (2) gradually establishing an arboretum as well as holding a certain area as a wild-flower reservation, with the idea that possibly at some future time this may become the new botanical garden.

The Garden is open to the public every day in the year except New Year's Day and Christmas—week days from 8:00 a. m. until sunset; Sundays from 10:00 a. m. until sunset. The greenhouses are closed every day at 5:00 p. m.

The main entrance to the Garden is located at Tower Grove Avenue and Flora Place, on the Sarah car line (No. 42). Transfer south from all intersecting lines.



WEST BRIDGE AT ARBORETUM

Missouri Botanical Garden Bulletin

Vol. XXIX JANUARY, 1941 No. 1

FIFTY-SECOND ANNUAL REPORT OF THE DIRECTOR

To the Board of Trustees:

The Director of the Garden has the honor to submit his report for the year ending December 31, 1940.

Much that must be included in a report of this kind is of a routine nature, partly, at least, a mere matter of recording various items which, as the years go by, constitute a more or less important chapter in the history of the institution. Last year it was a pleasure to record for the first time the practical interest in the Garden of a large number of individuals, as well as many garden clubs and other organizations, as manifested by their gifts to the "Friends of the Garden" fund. Never before had there been the need of giving the public an opportunity to assist in the maintenance and development of what is recognized as a leading asset of St. Louis.

That Henry Shaw anticipated such a time is evidenced by his attempt to assure additional income for the Garden by reserving a 200-foot strip around Tower Grove Park which was to be leased "for villa purposes," the entire income to be paid to the Garden; also his provision that an admission fee might be charged should the income prove insufficient. What he could not foresee was the increased cost of operating his Garden (he paid $1.00 a day for labor and everything else was in proportion), the large amounts of the income that must be paid in taxes to the city of his adoption (now about one-fourth of the gross income—two and one-half million dollars paid to the city of St. Louis in general and special taxes since Mr. Shaw's death), and the great decrease in income from invested funds. Henry Shaw loaned money occasionally, receiving never less than 10 per cent interest and sometimes more.

The fact that he started with a little stock of cutlery in 1819 and in twenty years built up a business showing a net profit of $25,000 a year would have been enough to lead most people to think that an endowment worth from two to three million dollars should be sufficient for any botanical garden, in perpetuity. But Henry Shaw didn't think so. His imagination, his vision, his dream of what the Missouri Botanical Garden was to become would necessarily make the original endowment inadequate, and he thought he had provided for the needed increase.

It therefore is a great pleasure to record, as last year, that friends of the Garden have continued to manifest their interest and have continued to contribute towards its support. In 1939, in addition to the $43,745 from larger gifts, $6,871.73 was received in smaller amounts from a great number of Garden friends. This year many of those who gave before, together with new subscribers, have contributed $6,563.40 to the "Friends of the Garden" fund. While the fund has not reached the sum of $25,000 annually, which it is hoped may ultimately be attained, the spirit with which contributions are now made would make it seem possible, as citizens learn the need of more funds. Among the many expressions of good will that accompany gifts, the following letter is an excellent example of the affection in which the Garden is held:

> My dear Dr. Moore,
> Accept this *small* gift as a token of "Love" for "Shaw's Garden," and I hope every one in St. Louis who visits the lovely garden will send $1.00 or more if they can afford it. I know it could then *"sustain"* its beauty for many years to come. Best wishes.
>
> A taxpayer & a *good citizen.*

IMPROVEMENTS AT THE ARBORETUM

The east bridge, for which excavating began in December, 1939, was completed and opened to traffic on April 20. The construction of the west bridge was delayed by the cold weather of January and February and was not opened until June 19. These bridges, constructed of steel and concrete with elaborate foundations and breast-walls to withstand the sudden rush of water from Brush Creek at certain seasons, are two of the most expensive items of the year's improvement. With their construction and the grading and gravelling of the last section of road the new "circle drive" is completed. A certain amount of bank grading has been left for spring since it was not possible to cut sufficient mulching material for the new slopes this fall. The use of mulches on newly graded banks has produced such satisfactory results that this will become a standard practice. Perhaps the only objection to this procedure is that so much land must be mowed and raked and the mulch hauled to supply enough material for even a thousand yards of new roadside. A properly mulched road edge, while not at all spectacular, actually represents many hours of labor and the use of much machinery.

An old-fashioned rail fence has been erected on both sides of the new roads. This required 8,498 split red- and white-oak rails. Some difficulty was experienced in locating a woodsman who had not forgotten the art of splitting rails and who operated in a region having enough large trees suitable for the purpose. The rails which were purchased were hauled nearly fifty miles. A rail fence is especially suited to the landscape development of the Arboretum. Many kinds of plants can be naturalized along such a fence, and any portion can be taken down to permit machinery to enter a field; in case of fire there will be no gates restricting the movement of apparatus.

The moving of large trees required some time in March when 20 oriental crabapples were moved from the plantation to a point near the reservoir. At the same time 6 large Japanese black pines were brought together, forming a new group in the Pinetum. On November 20 more crabapples were moved to the banks of the Reflecting Pool east of the reservoir. During this month also 36 sweet-gums were taken from near the nursery and planted as a group in the area set aside for large plantations of native trees. Two large boxwoods were moved to either side of the lodge at the main gate, and 52 more were planted at certain intersections in the Pinetum. The tree-moving operation in November required 841 man hours, the work being done with a tree-mover designed at the Garden for use with the F-20 tractor. Each tree was thoroughly watered, some requiring 300 gallons, all of which was hauled by tank truck. The sawdust used as a mulch was hauled from a mill 10 miles away.

A septic tank of ample capacity was installed at the main gate, the effluent from which discharges into a creek entering the Pinetum Lake. Nearly 500 yards of soil were hauled to complete the grading in the north edge of the Pinetum, where 6 new catch-basins and 9 new head-walls were installed on existing culverts. Much of the soil used here was taken from the excavation now forming the pools at each bridge.

One of the important additions at the Arboretum is a service shed covering 5,000 square feet. The work of pouring the concrete footings was begun on June 5, and the building was completed in October. The construction is of used brick—73,000 bricks were hauled from St. Louis—with steel roof joists and roll roofing over 2-inch decking. There are 10 sliding doors 10 feet high and 10 feet wide, designed to accommodate the largest equipment now in use. The building is in the form of an "L" and provides space for a machine shop as well as a 2-door section for the fire apparatus and tank truck.

Another 6-inch cast-iron pipe line was laid from the underground cistern back of the Orchid Range south to the Manor House, a distance of 1,500 feet, with one lateral line 100 feet long for a hydrant. This line supplies three fire hydrants and is intended for both fire protection and irrigation. A "tee" has been placed in the line to serve the seed-beds and the new box garden, as well as the azalea planting to the east.

The large 300,000-gallon reservoir, completed last year, was filled from the river both in spring and fall, after which the pumps were disconnected and placed under cover. During the year more than 25,000 gallons of water were used from this reservoir for mixing mortar and concrete and for irrigation, all hauled in the tank truck. The pipe line from this reservoir is now completely covered and it is probably freeze-proof. Over 100 loads of soil were required to cover the section laid on top of the ground through the woods.

One hundred and twenty-five truck hours per month are needed to do the miscellaneous hauling. This is exclusive of such large trucking operations as hauling gravel for roads, mulch for slopes, or soil for new plantations.

Work was begun on the preparation of a new box garden, for which material has been grown from seed and cuttings during the past. The first step involved 900 yards of good soil from the flood plain or bottom land. This will be incorporated in the top soil of the area to be developed and should reduce the need for fertilizers and perhaps even irrigation, after the planting is finished. A somewhat similar treatment has been started for a future azalea display. In this case 2 truck loads of orchid peat and 5 truck loads of rotted sawdust were broadcast after the first plowing. This will remain until spring when it will be tilled several times to incorporate thoroughly this humus with the top soil.

Most of the very cold weather of last January and February was devoted to the clearing of old fence rows north of the reservoir, with similar work in the Pinetum and around the crabapple planting. The removal of such unnatural subdivisions of the areas permits a more efficient use of mowing machinery, not to mention the great improvement in the landscape. More clearing is contemplated this winter, when brush will be removed from areas north of the reservoir and along Brush Creek.

Mowing required much time during the summer. Three hundred acres were cut over at least once, and certain portions of the Pinetum were mowed three times. Part of the cutting and raking was timed to observe the effect on the blue grass, in pursuance of the effort to learn more about the care and control of this grass in the vicinity of St. Louis. All of the improvement work at the Arboretum has been under the supervision of Mr. A. P. Beilmann, Arboriculturist.

SUNSHINE RECORD

Month	*City Garden*	*Arboretum*
January	88	129
February	58	79
March	125	147
April	162	167
May	251	256
June	254	260
July	307	314
August	230	222
September	257	235
October	244	249
November	131	138
December	92	108
	2,199	2,304
		2,199
Excess of sunshine hours at Arboretum		105

CITY GARDEN CONSTRUCTION AND MAINTENANCE

While much of the new work involving permanent improvement has been done at the Arboretum, the city Garden has not been neglected. Perhaps the most important, certainly the most expensive alteration, was the installation of stokers to replace hand-firing with high volatile coal under two of the boilers. The third boiler will, when needed, continue to be hand-fired, but with smokeless fuel. A small stoker was also provided for the residence at the corner of Shaw and Alfred avenues, so that all sources of heat for any of the structures in the Garden are now smokeless, either stokers, gas or oil being used.

A new ash-hoist was provided at the main heating plant, and the usual thorough overhauling and repairs made wherever needed. Much rearranging of the heating coils in various houses was attended to, including the complete relocation of about 6,600 feet of pipe in the Floral Display House, the rearranging of coils in the orchid-seedling house, and the addition of pipe in the lean-to storage house.

Reference was made last year to the great improvement made, through a project of the WPA, in removing the embankment at the curb and rebuilding the sidewalk along the entire Tower Grove frontage. A continuation of this project in 1940 resulted in widening the sidewalk, necessitating the building of a curb-wall along the inner edge of the walk to hold the earth embankment next to the wall. This change made it possible for the Garden to plant 78 pin oaks and 4 ginkgo trees along the outside of the wall, and to improve the main gate entrance with 4 large hollies, some flowering crabapples and suitable shrubbery.

After the Garden had removed the earth along the inside of the stone wall on Shaw Avenue, thus allowing the underpinning and repairing of the wall, another WPA project lowered and remade the sidewalk along Shaw Avenue. This made it possible, for the first time since Shaw Avenue was constructed at a lower grade, to walk along the walled side of the Garden at a safe level.

To mention all of the additional repairs and replacements made at the city Garden may seem to be out of place but may help to indicate that the activities of a botanical garden consist of more than raising plants or building up a library and herbarium. Some of the items which have occupied the repair and construction squad during the past year are: rebuilding supporting walls for iron-grating in water-lily tank house; tuck-pointing inside of rock wall from Russell Avenue to administration building; installing under-drainage and bringing to grade with 100 loads of earth the tract just west of the Director's residence; new roof on storage shed and shop building; new barbed-wire on Magnolia Avenue fence; rebuilding roofs of Aroid and Alcove houses, which involved removal of all glass and renewal of sash bars and iron braces where necessary; removal of glass sides from Coffee House, Cycad House, and Cactus House in order to replace with new galvanized angle iron the supports which, being covered with wood trimming, had rusted out; painting exterior of Engineer's and Assistant Engineer's houses, interior and exterior of Alcove and Aroid houses, vestibules of Cactus and Coffee houses, and Linnean House exterior. The mere routine repair work and painting of chairs, benches, screens, ventilators, and vent controls, down-spouts, gutters, machinery, drinking fountains, pergolas, equipment of all kinds, including power lawn-mowers, trucks, tractor, snow-plow, power spraying truck, etc., constitutes a very considerable item in the year's work.

MAIN CONSERVATORIES AND EXOTIC RANGES

Collections of growing palms are invaluable in a botanical garden, since this group contains some of the noblest forms of vegetation. During the past decade a number of the Garden palms have been removed as they grew too large for the Palm House. In an effort to replace as many of them as possible, a visit was paid to the Montgomery Palmetum at Coconut Grove, Florida, and an exchange of plants was arranged. Numerous young palms have been received, including such rare species as *Pinanga insignis, P. maculata* and *P. philippinensis, Livistona cochinchinensis, L. Merrillii, L. Robinsoniana* and *L. Saribus, Hyophorbe amaricaulis* and *H. Verschaffeltii, Calamus Biri* and *C. ornatus, Oncosperma gracilipes, Daemonorops ochrolepis, Caryota Cumingii, Corypha elata,* and *Roystonea regia.*

The vanilla plant in the Palm House has made remarkable growth since it was planted there in 1938 and during the spring was copiously covered with greenish blossoms for the first time. About 50 of the flowers were hand-pollinated and the resultant beans from which the extract is made can now be seen.

Additional species of rubber, belonging to the genus Ficus, were secured from the Citrus Experiment Station, Riverside, California, to enlarge the considerable collection established in the Economic House. The trees of this group all possess beautiful, dense, glossy, evergreen foliage, in some varieties large, thick and leathery, in others small, laurel-like and dark green. The new additions include *Ficus alba, F. asperrima, F. Krishnae, F. macrophora, F. mysorensis, F. padifolia, F. Payapa, F. quercifolia* and *F. Tsiela.*

In the Coffee-Banana House there is an ornamental vine which hangs in bright green festoons from the rafters and attracts the attention of visitors. This is *Agdestis clematidea,* common in the Mexican wilds. The roots, weighing several pounds and a goodly portion being above ground, often evoke much comment because of their peculiar shape. In Mexico it is known as "Tripas de Judas" or "the Bowels of Judas." Each season the vine is covered with masses of waxy, white, star-shaped blossoms, which unfortunately have a slightly disagreeable odor.

The spectacular Bougainvillea "Crimson Lake" had to be pruned severely and was also transplanted into a more suitable location amid the coffee trees.

Some sections of the Fern-Cycad house were entirely renovated with fresh soil. Well-rotted leaf-mold was applied to all the beds, most of the ferns responding to the mulching. The two handsome specimens of Mexican cycad, *Dioon spinulosum,* with glossy green fronds six feet in length, produced sterile cones two feet long.

The cacti and other succulents, so well represented in the Garden's desert houses, are coming more and more into favor as the public becomes better acquainted with their interesting forms and beautiful flowers. Several outstanding specimen plants of euphorbias and various cacti which had been grown for many years in the Forest Park Greenhouses were presented to the Garden and now are part of the permanent plantings in the Cactus House. Three large barrel cacti, *Echinocactus Grusonii,* approximately fifty years old, are considered the most valuable plants in the lot, and three ten-foot African tree spurges, *Euphorbia similis,* were a welcome addition to the collection.

A shipment of 1,070 rooted cuttings of various unnamed cacti was received from the U. S. Department of Agriculture with the stipulation that notes be kept and flowering material (when available) sent to the U. S. National Herbarium for deposit. The plantlets were potted and can be referred to such genera as *Acanthocereus, Cleistocactus, Epiphyllum, Harrisia, Heliocereus, Hylocereus, Lemaireocereus, Pereskia, Pereskiopsis* and *Selenicereus.* The material was collected originally by botanists working with Drs. J. N. Rose and N. L. Britton in their study of the Cactaceae (1912-1923), among whom were Prof. C. Conzatti, Mrs. T. D. A. Cockerell, Dr. E. Palmer, Dr. C. A. Purpus, Charles C. Deam, William R. Maxon, C. R. Orcutt, John K. Small, H. Pittier, O. F. Cook, and others. Many of the original plants did not come into flower during the period of publication of the Britton & Rose monograph (1919-1923) or the notes accompanying the material were lost, so they could not be included in the appendix.

The Bromeliad House was entirely replanted with crotons, dracaenas, dieffenbachias, bromeliads and other ornamental varieties. About 180 hanging baskets of epiphytic cacti, orchids, and bromeliads are suspended over the walk as an added attraction. Most of the potted bromeliads and orchids in the Plant-Curiosity House were renovated and new material added when necessary.

All of the collections mentioned above are under the care of Mr. Ladislaus Cutak, in charge of Succulents.

OUTDOOR GARDENS

Unlike in the summer of 1939, rains were neither frequent nor abundant in 1940 and early in the season the various outdoor gardens had to be watered. By the end of July, with accumulated deficiency of 10.32 inches of precipitation since the beginning of the year, it was evident that we again were gardening in a particularly dry summer. Some of the gardens are equipped with sprinkler systems and may be watered whenever necessary but the Economic Garden and the perennial borders on the knolls suffer much in dry years. Although much watering is done with the hose, it is impossible to supply the beds with an adequate amount of moisture for proper plant growth. The fall months were likewise extremely dry, and at the end of November there was a deficiency of 13.51 inches of rainfall for the year.

Iris Garden.—All of the clumps of iris in the iris display garden were divided and replanted in late June and early July. This is a large garden and the total time required for the work was equivalent to one man working 32 days, or a total of 256 hours. In October, Mr. I. A. Stevens, of Clayton, contributed 85 of the newer irises, a most welcome addition to the collection. It is impossible for the Garden to buy the many new varieties which are offered each year, and it is only through the generosity of growers that the collection can, to some extent, be kept up to date.

The Garden has at times been criticized for retaining the older varieties. Most iris fanciers who visit the Garden are undoubtedly disappointed to find that though it has a large iris collection the bulk of it is made up of old varieties, many of which are no longer in the trade. There are several reasons why many of these seemingly inferior varieties are really superior for a large public collection in a botanical garden. In the first place, they are smaller-flowered. Because of that fact, although they do not provide a breath-taking display when in full bloom, they do not look so unattractive as the large-flowered kinds when they are going out of bloom. In a private garden where the old blooms can readily be removed this is not an objection, but in a large public collection where such attention is clearly impossible a large number of smaller-flowered sorts keeps the collection, as a whole, looking better over a longer period. Many of the older varieties, too, have clearer though often cruder colors. They may be less attractive in a perennial border but when thousands of them are massed together it makes for a brighter and fresher display. Some of the older iris have, by no means, lost their charm or beauty through the years. In breeding for size, iris fanciers have also had to sacrifice somewhat the good growing qualities of the older sorts. In a private garden one is glad to have beautiful varieties even if they take a little coddling now and then. In a large public collection the bulk of the display must be provided by old reliable varieties which can be depended upon to flower well every year, without special attention.

More important, however, is the necessity of retaining the parents of some of the newer hybrids. For the sake of iris breeders and iris lovers the history of the development of American irises must some day be written in as much detail as possible. When this is done a collection of older varieties will be invaluable, since it will show the steps by which the bright colors of the European diploid irises were given greater size and more subtle shadings by being fused with the polyploid irises of Asia Minor. When that history is fully known iris breeders will want to return to some of these older varieties to regain some of the possibilities which have been bred out of more recent kinds. This has been the history of other kinds of flowers, notably roses, tulips, and hardy pinks. We have, therefore, the paradox that the older and more worthless varieties become the more potentially valuable in a collection made up in part of such old varieties! Finally, many amateurs visit the iris garden to obtain the names of flowers in their own garden by matching them with those in the iris collection. If many of the old standard varieties were eliminated this would not be possible.

Rose Garden.—The climbing roses were severely damaged by the cold winter which was ushered in with the beginning of 1940. The bush roses were protected with snow during the coldest weather and were not injured. These bloomed well in the early summer and again in the fall. Several varieties of roses were donated by the Conard-Pyle Rose Company, of West Grove, Pennsylvania, and the Jackson & Perkins Company, of Newark, New York. The first Sunday in November, being a balmy day, there were more visitors to the Rose Garden than on any other Sunday in the year. Up to that time there had been no killing frost, and this fact provided the unusual combination of three distinct floral displays for the 12,000 visitors who came to the Garden for the opening of the chrysanthemum show. In the main garden the pools were filled with tropical water-lilies, the Rose Garden was in full bloom, and the chrysanthemum show, the largest floral display of the year, was in progress.

Italian Garden.—The grass borders which form the patterns of the beds in the Italian Garden had become very narrow through repeated edging over a period of years. All of these borders were replaced in the spring with one-foot sod strips, a total of 310 square yards of sod being required.

INDOOR FLORAL DISPLAYS

On January 2 the Christmas display of poinsettias was replaced with the late-blooming Garza Supreme chrysanthemums and geraniums. The orchids were shown in shadow-boxes on January 28, and in early February plants of *Primula obconica* were added to the display. A southern azalea garden was reproduced for the Greater St. Louis Flower & Garden Show held at the Arena from March 9 to 17. The Easter display of cinerarias and azaleas was installed in the Floral Display House on March 22. The azaleas were gradually replaced with schizanthus, marguerites, annual chrysanthemums, and other spring-blooming annuals. Over 200 flowering plants were sent to the Christ Church Cathedral for the annual flower sermon on April 28. The St. Louis Horticultural Society held its spring flower show on May 25 and 26. Following this show the hydrangeas and pelargoniums were shown, and by June 6 the summer display of fancy-leaved caladiums was completed. On October 5 and 6 the St. Louis Horticultural Society held its dahlia show, and the Veiled Prophet Queen's bouquet was on view on October 10. The chrysanthemum show lasted from November 3 to December 1, and was followed by the poinsettias.

An efficient electric soil sterilizer, of one-half cubic-yard capacity, was installed in the floral department in September. The first distinct improvement this sterilizer effected was the absence of "damping-off" diseases in the propagating bench. Improved plant growth and the absence of weeds in the potting soil have also been noted.

Most of the outdoor collections, as well as the growing and arranging of plants for the various flower shows, are in the hands of Mr. Paul A. Kohl, Floriculturist.

EXPERIMENTAL GREENHOUSES

In this range, in charge of Dr. D. C. Fairburn, Horticulturist to the Garden, many new varieties of plants are constantly being tested. During the past year over 200 different varieties were raised from seed, most of them being transferred to the nursery for observation. Included were the 1940 All-American annuals.

Experiments on the propagation of rhododendrons, azaleas, and hollies have demonstrated that tip cuttings root very well in equal portions of sand and acid peat, using a glass enclosure (Wardian case) with slight bottom heat. *Rhododendron roseum elegans* and *R. ponticum* responded almost 100 per cent when propagated in the fall by leaf-bud cuttings. Various kinds of magnolias, including *M. grandiflora,* which flowered at the Garden last year, have been raised from seed stratified over winter in flats of sand stored in a cold-frame.

The seedling work on orchids has expanded considerably. Many hybrid seedlings in culture flasks and pots are now on hand. Hybridization of outstanding varieties continues. The following physiological experiments on orchid plants are now in progress:

1. Determination of the optimum amount of sunlight for maximum growth.
2. Exposure of plants to electric light at night.
3. Use of gravel, cinders, etc., as a potting medium in place of the usual Osmunda fiber or peat.
4. Treatment with various nutrient solutions, vitamin B_1, carbon dioxide, and ammonia.

The benches in the Orchid House have been covered with heavy ½-inch mesh wire netting instead of using the ordinary type of wooden staging. This wire netting is a very serviceable base on which to set potted plants of all sizes. It provides perfect drainage and good air circulation. An occasional light coat of aluminum paint eliminates the possibility of rust.

The enrollment in the advanced amateur garden course was almost double that of the previous year. The newly constructed concrete benches in the greenhouse and the use of the basement as a lecture room made it possible to accommodate the increased attendance. Several hundred pots of bulbs, about 8,000 cuttings of various plants, and over 10,000 seedlings of annuals, perennials, etc., were raised by the class members in the greenhouses.

SUPERVISED INSTRUCTION FOR SCHOOL CHILDREN

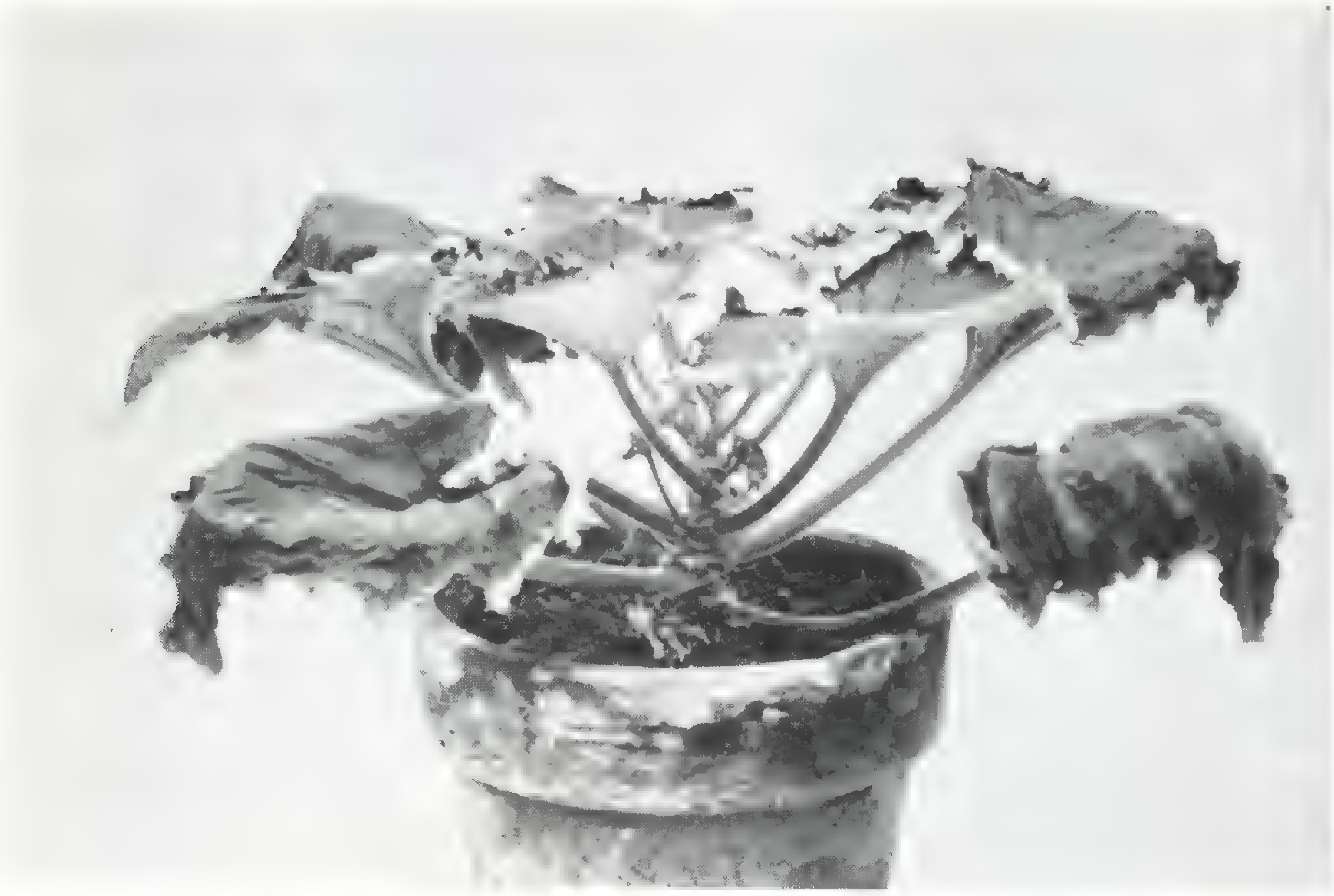
Previous reports have commented at length on the use now being made by school children of the facilities offered at the Garden. Through the coöperation of the Board of Education, Miss

Clara M. Heising continues as Special Nature Study Teacher. During the year more than 10,000 pupils from elementary and high schools have had lessons in nature study, making use not only of the plants and trees, but birds, insects, and other living creatures of interest. Individual pupils, as well as teachers, have expressed their great appreciation of the opportunity to study the wonders and beauty of Nature under such favorable circumstances.

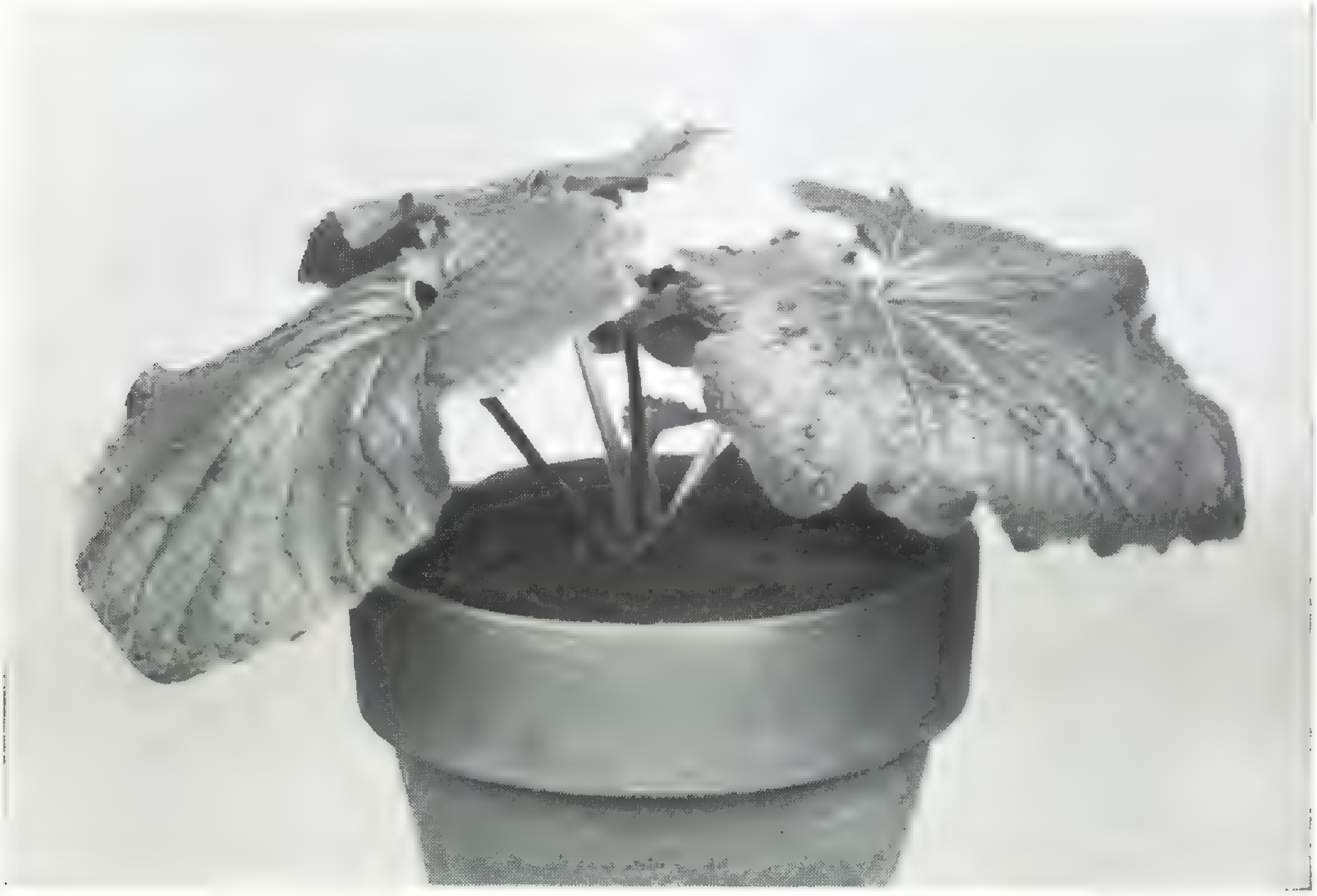
A recent report from the Speyer School, issued by the Board of Education of New York City, emphasizes the value and importance of this kind of instruction for certain types of pupils. Instead of conducting the classroom in the ordinary manner, the new curriculum stressed the importance of out of doors and nature study: "Every visit to a park or botanical garden brought forth a mine of teaching aids and valuable supplementary classroom material. For example, from one visit the children returned with leaves, flowers, seeds, birds' nests, two butterflies, a grasshopper, three unidentified bugs of the beetle family, and various stones."

SMOKE ELIMINATION

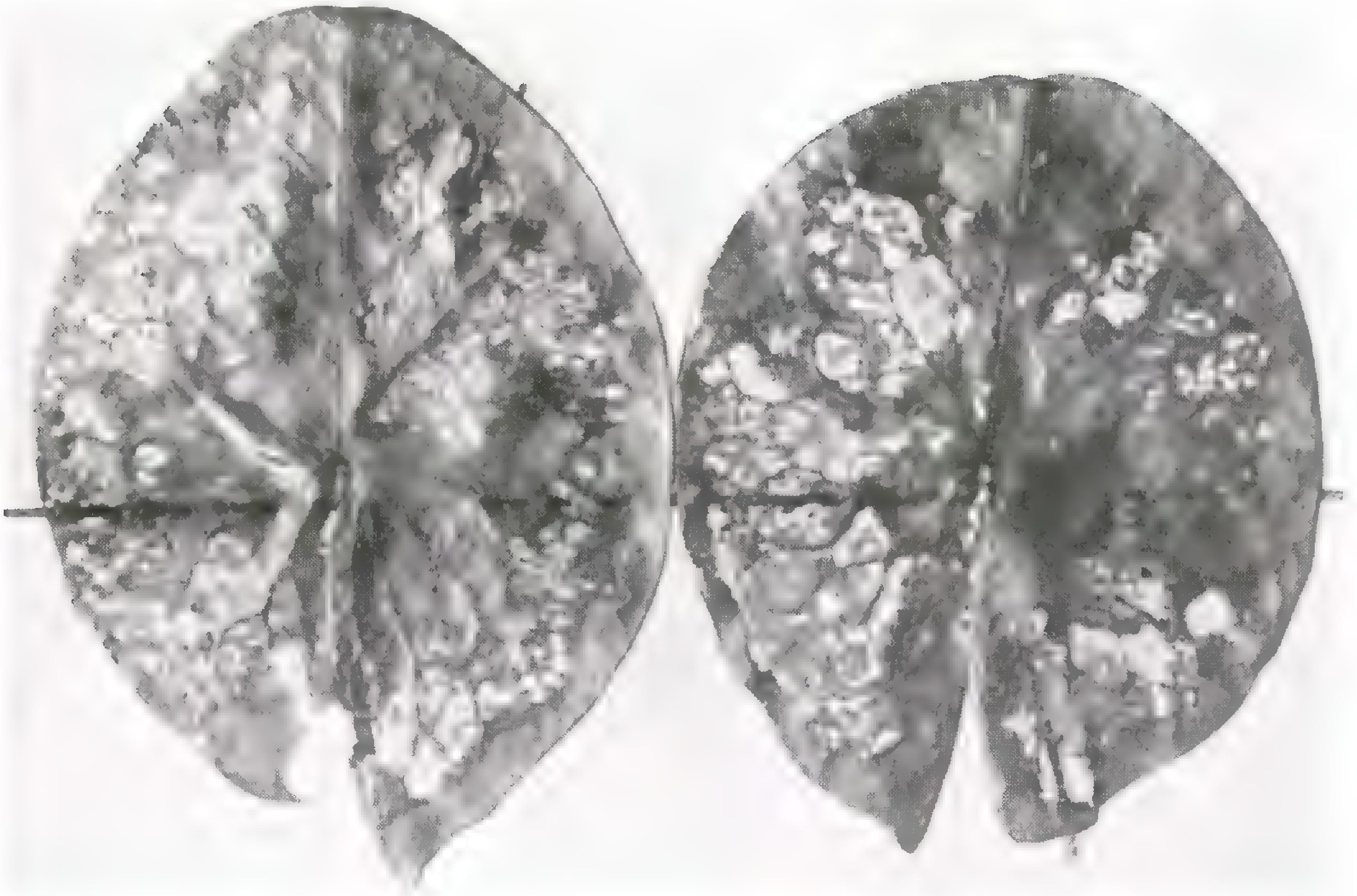
In one way it may seem too early to judge of the effect of the smoke-elimination campaign on the plants at the Garden. On the other hand, the evidence is so satisfactory, coupled with the fact that in the past the most serious damage has always been in the months of November and December, that some conclusions may be drawn. Certainly there has been such a marked improvement that one is inclined to become optimistic about the possibilities for successful gardening in the city. It is hoped that the condition may be permanent. Any one who has been intimately connected with the growing of plants in St. Louis in the past years knows only too well that each year a coating of dirt has formed on the plants as soon as the fires were started in the fall. In the Garden greenhouses white flowers were peppered with a deposit of soot each day. Out of doors, trees and shrubs all looked alike as far as twig coloration was concerned. This fall the gray maples, the white sycamore branches, the red- and yellow-stemmed dogwoods and the green sassafras twigs are just a few examples of the brilliant twig coloration which is so noticeable compared with the



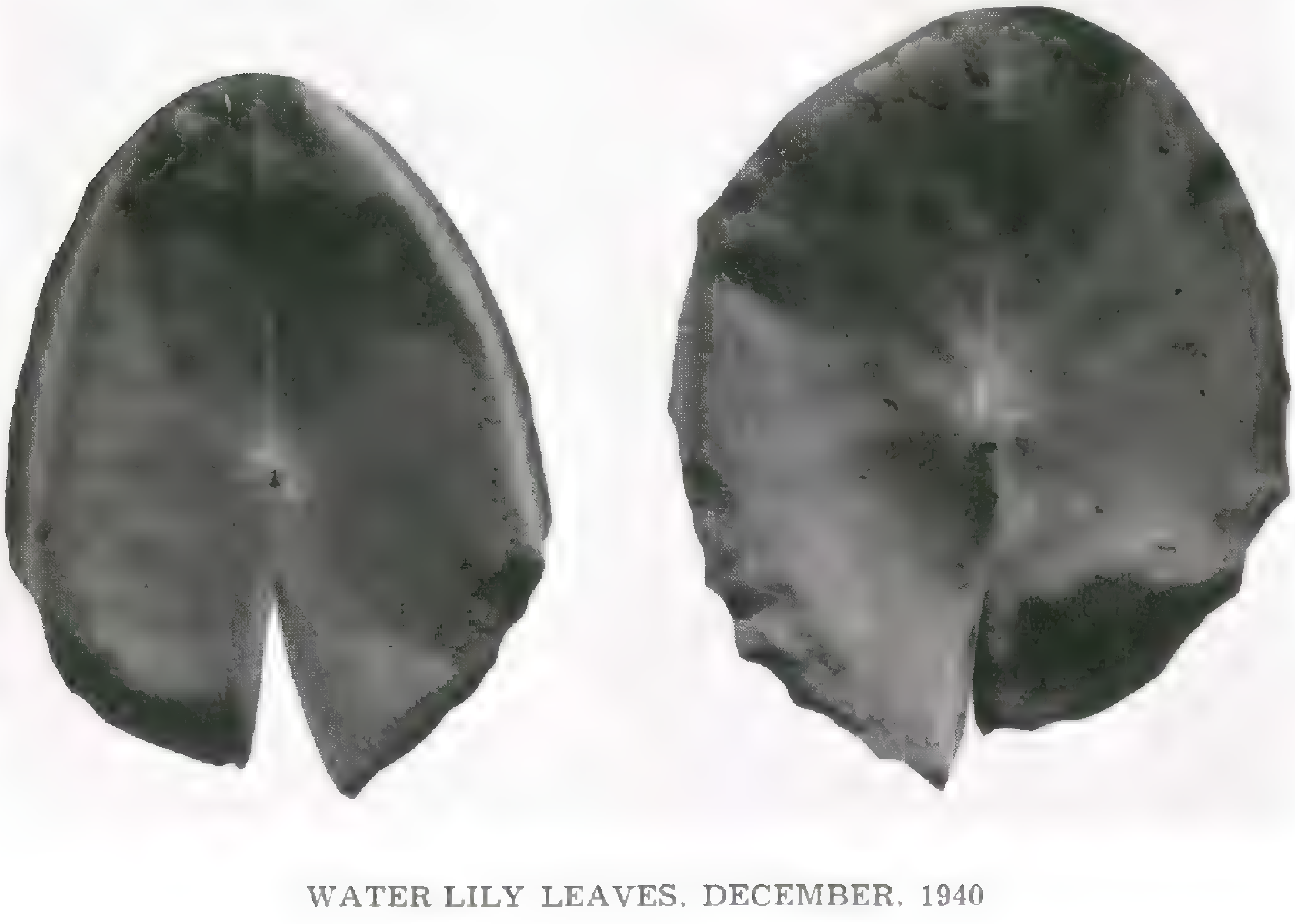
CINERARIA PLANT SHOWING EFFECT OF SMOKE IN A PREVIOUS YEAR



CINERARIA PLANT, DECEMBER, 1940



WATER LILY LEAVES. EFFECT OF SMOKE IN PREVIOUS DECEMBER



WATER LILY LEAVES, DECEMBER, 1940

dirty twigs of previous years. To prove the point, one needs only to rub the fingers over the twigs of shrubs or the leaves of holly to discover that the usual coating of soot is lacking.

So far as plants are concerned there are two effects produced by the presence of smoke with its accompanying gases in the atmosphere. For it should be understood that it is not soot alone that is responsible for the deleterious effect of what we call "smoke," but it is the poisonous gases such as result from the sulphur in the coal which cause the most noticeable and serious damage to plants. One effect is produced by the more or less steady but slight amounts of poisonous substances in the air throughout the coal-burning season. This is not immediately noticeable, but it gradually reduces the vitality of the plant until it practically ceases to grow and in the course of a few years dies from no apparent cause. This condition is what has made the growing of evergreens in certain parts of the city so unsatisfactory. With potted plants in greenhouses, outdoor flowering shrubs, and blue-grass lawns, the effect is not easily recognized unless the plants are compared with others growing in a smoke-free atmosphere.

The more noticeable damage due to smoke is that which results from a concentrated cloud lasting twenty-four hours or longer. It is such visitations which cause the gardener almost to give up in despair any effort to produce the growth and flowers he would like. Full accounts of the disastrous effects of such smoke clouds have been given, with illustrations, in former numbers of the BULLETIN (Vol. 5, No. 11; Vol. 12, No. 6; Vol. 12, No. 10; Vol. 16, No. 1; Vol. 20, No. 2), and it is the absence of any indication of such damage this fall that makes it seem possible that a very considerable percentage of poisonous matter from the air has been eliminated. During the past twenty-five years, experience has shown that certain plants and flowers are particularly sensitive to smoke. These "smoke indicators," as they are called at the Garden, include such plants as begonias, cinerarias, tropical water-lilies, fuchsias, etc., which may be entirely defoliated during a smoke cloud, as well as certain ferns, cocoa, coffee, bromeliads, cinchona, and other tropical plants, which show discoloration of the leaf edges or tip, or of the entire leaf. Such effects are practically instantaneous in that they occur during a single dense visitation of smoke, lasting twenty-four hours or less.

Latent effects of smoke, manifesting themselves over a period of time, and evidenced by the abnormal browning or dropping of leaves, as well as in the drooping or discoloration of flowers, have been previously observed in a large number of plants. A list of some of these was published in the February BULLETIN for 1932. Thus far this season, neither this latent effect nor the sudden "over-night" damage has been observed in any of the plants previously known to be particularly sensitive to smoke.

This is not the notion of a single individual, but is the consensus of opinion of all the various gardeners who have anything to do with plants either in the greenhouse or out of doors.

DISTRIBUTION OF PLANTS AND FLOWERS

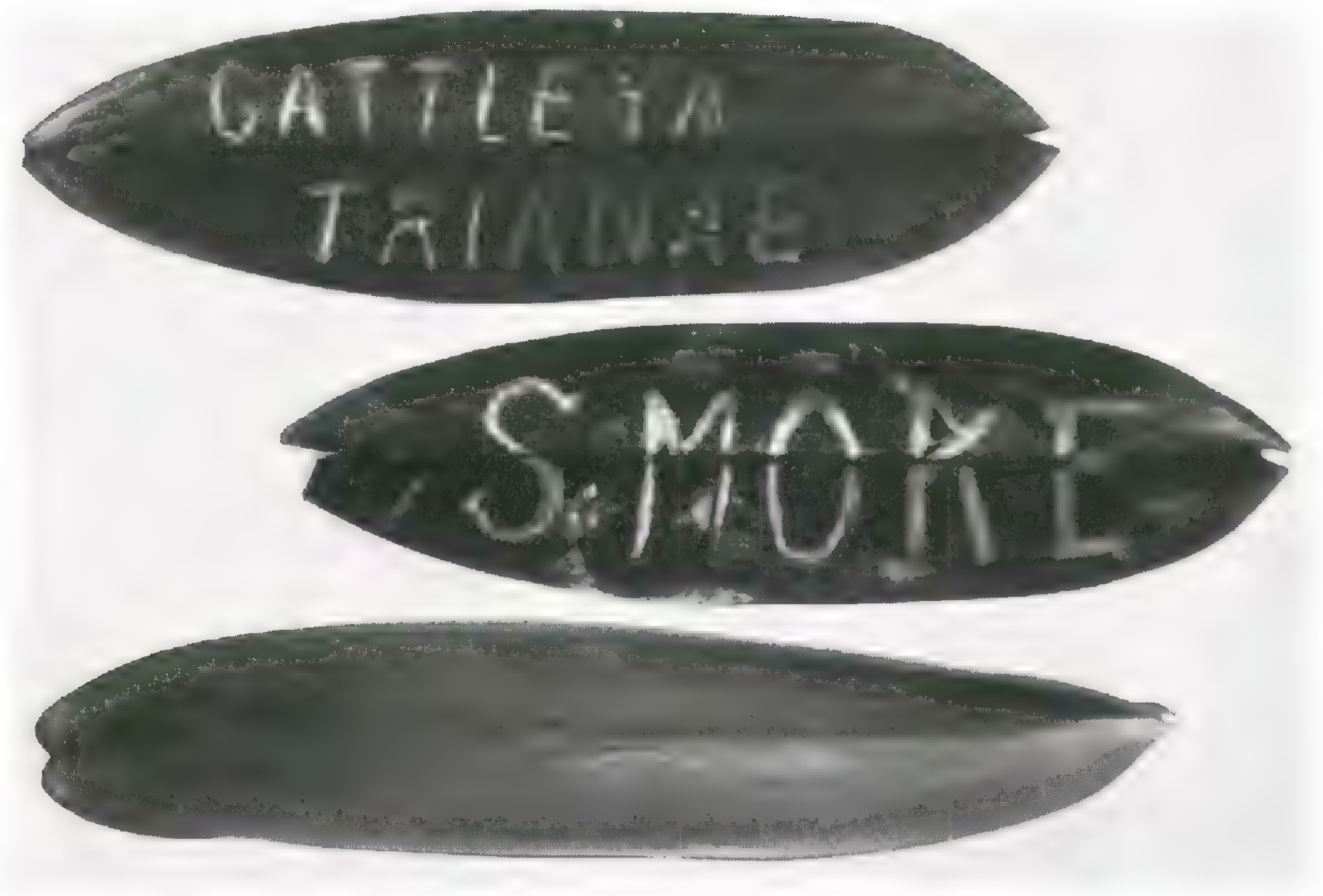
The question is frequently asked, "What becomes of all the surplus plants and flowers raised at the Garden?" The answer is, "There is no surplus; every effort is made to economize space and labor by growing just enough plants for a special use or show." Even if there were extra plants to dispose of, it is the established policy of the Garden not to give material to individuals. The Missouri Botanical Garden should not interfere with the business of any commercial florist or nurseryman.

After a special floral display such as the chrysanthemum show, there are, of course, many flowers still well-enough preserved to furnish pleasure to those unable to attend the show. All plant material of any kind, including flowers, from the various shows, are turned over to the Book and Flower Guild, which for years has most satisfactorily and efficiently attended to the distribution to charitable institutions. From the last chrysanthemum show, for instance, the following institutions were supplied and many letters have been received testifying to the joy and pleasure brought to the recipients:

Colored Old Folks Home
Koch Tuberculosis Hospital
Night & Day Camp
Mt. St. Rose Sanitarium
St. Louis Altenheim
Home of the Friendless
Alexian Brothers Hospital
Salvation Army Women's Home
Lutheran Convalescent Home
Carrie Elligson Gietner Home
Little Sisters of the Poor
South Side Day Nursery
Kingdom House
St. Mary's Infirmary
Little Flower Retreat House
Bethesda Hospital
Memorial Home
People's Hospital

CINERARIA AND OTHER PLANTS UNDAMAGED, JANUARY, 1941

BEGONIA AND PRIMULA PLANTS UNDAMAGED, JANUARY, 1941



SOOTY ORCHID LEAVES GROWN IN ST. LOUIS IN PREVIOUS YEARS CONTRASTED WITH A SOOT FREE LEAF AT END OF 1940

DELICATE ALBINO ORCHID GROWN IN ST. LOUIS, IN DECEMBER, 1940, FOR THE FIRST TIME, UNDAMAGED BY SMOKE

Sunshine Mission
House of Detention
Colored Orphans' Home
Phillips Hospital
Children's Home Society of Missouri
The Christian Orphans' Home
Orthodox Jewish Old Folks Home
German Protestant Orphans' Home
Convent of the Immaculate Heart
Lutheran Altenheim
Christian Old People's Home
Russell Home
Masonic Home
The Girls' Home
Helpers of Holy Souls
Mary Ryder Home
Methodist Orphan's Home
Good Samaritan Home for the Aged
City Sanitarium
Isolation Hospital
City Infirmary
Jewish Children's Home
Miriam Convalescent Home
St. Louis Protestant Orphans' Home
Bethesda-Dillworth Memorial Home
Kirkwood Old Folks Home
St. Joseph's Institute for the Deaf
German St. Vincent's Orphan Association
Oblate Sisters of Providence
Mother of Good Counsel Home

RESEARCH AND INSTRUCTION

Dr. J. M. Greenman, Curator of the Herbarium and Professor in the Henry Shaw School of Botany of Washington University, has devoted the major part of his time and efforts during the year to curatorial duties of the herbarium. He has continued to direct the research work of graduate students majoring in taxonomy; and he has also conducted advanced courses in comparative morphology and taxonomy of the higher groups of plants, as scheduled in the catalogues of Washington University.

Dr. Greenman, in the limited time at his disposal, has continued research on various groups of flowering plants, particularly Compositae, and on monographic and floristic projects.

Dr. C. W. Dodge, Mycologist to the Garden and Professor in the Henry Shaw School of Botany of Washington University, spent most of the year in the study of lichens from Antarctica and the subantarctic islands of the Indian Ocean (see Mo. Bot. Gard. Bull. 28:19. 1939). Mr. Timothy Murphy has assisted in the preparation of microscopic slides, and Mr. Donald F. Flint and Mrs. E. C. Berry have aided in clerical work and in the insertion of specimens in the lichen and fungus herbaria. All of the lichens awaiting study have been sectioned and sorted to genera (about 3,500 collections) except a large series from New Guinea received during the summer and autumn. All of the material of *Cladonia* sect. *Cladina* has been redetermined in accordance with the recent monograph of des Abbayes, and a large amount of *Ramalina* determined and inserted in the herbarium.

Dr. Dodge has been appointed Curator of the Lichen Herbarium of the Sullivant Moss Society and has installed this herbarium in a steel case at the end of our lichen herbarium where it is available for loan to members and for consultation by our staff and visitors.

Under a grant from the International Cancer Research Foundation, a study of the action of methyl cholanthrene and other carcinogens on *Saccharomyces ellipsoideus* has been concluded for the present. Dr. G. T. Johnson served as research assistant on this project until June 1. Since that time the results have been prepared for publication.

The usual courses of instruction and research have been given. Dr. G. T. Johnson offered a course in general bacteriology in University College and in the summer session before leaving for Central America as a Fellow of the John Simon Guggenheim Memorial Foundation. Mrs. Elizabeth Heuser Rosenbaum completed her thesis on *Gymnoascus trisporus* and related species and is offering a course in general bacteriology in University College this autumn. Mr. Ralph E. Rawlings completed his thesis on *Thielaviopsis basicola.* Mr. E. C. Berry has prepared for publication his monograph of the North American species of *Parmelia* north of Mexico. Routine determinations of various human and plant pathogenic fungi have been made as various cultures were received.

Dr. Edgar Anderson, Geneticist to the Garden and Engelmann Professor in the Henry Shaw School of Botany of Washington University, continues to devote the major portion of his research to the genetics of species crosses. The genetic analysis of a species cross in *Nicotiana* has been continued with very encouraging results. A similar study of inbred and crossbred strains of maize has led to new hypotheses of the genetic effects of inbreeding in corn. The work has been written up and will shortly be submitted for publication. A grant from the American Philosophical Society has made it possible to take up the study of variation in corn and its relatives in a very broad way, and since the first of March Dr. Hugh C. Cutler has been working on a special fellowship made possible by the grant. A monograph of the North

American genus *Tripsacum* is well under way, and Dr. Cutler has made extensive collections of maize, *Tripsacum,* and *Euchlaena* in Mexico and Guatemala.

Dr. Robert E. Woodson, Jr., Assistant Curator of the Herbarium and Assistant Professor in the Henry Shaw School of Botany of Washington University, has for several years been engaged in a revision of the species of *Asclepias* in the United States. This now is near completion. Concurrent with the revision of *Asclepias,* he has made a survey of all the North American genera of Asclepiadaceae, and the results of this study, involving a radical revaluation of the various elements, will be published in the ANNALS OF THE MISSOURI BOTANICAL GARDEN.

Several weeks during June, July, and August were spent by Dr. Woodson and Mr. Robert W. Schery in a collecting trip to Panama under the auspices of the Garden. Approximately 1,000 numbers of vascular plants were obtained. Work on the proposed "Flora of Panama" is occupying much of the attention of these two, with the collaboration of numerous botanists of America and Europe.

As in former years, most of Dr. Woodson's time has been spent in conducting classes offered by the Henry Shaw School of Botany of Washington University. These classes (general plant biology, morphology and taxonomy, particularly of the Missouri Flora) have continued to show satisfactory progress and increases in enrollment.

Graduates and Fellows.—The following appointments were made in the Henry Shaw School of Botany for the year 1940-1941:

Assistants in Botany (half-time assistants): Robert W. Schery, A.B. and M.S., Washington University (Taxonomy and Morphology); Ralph O. Erickson, B.A., Gustavus Adolphus College, St. Peters, Minn. (Taxonomy and Cytology); Eloise Pannell, B.Ed., Southern Illinois State Normal University, Carbondale (Genetics and Morphology).

Washington University Fellowships: Gerald Bruce Ownbey, B.A. and M.A., University of Wyoming (Taxonomy).

Independent Students: Edward C. Berry, B.S. in Ed., State Teachers College, Warrensburg, Mo., M.A., University of Missouri (Mycology); Rev. Robert R. Brinker, O.F.M., A.B., St. Joseph's College, Westmont, Ill., Graduate of Theology, St. Joseph's Seminary (Taxonomy); William L. Brown, B.A., Bridgewater College, Bridgewater, Va., M.S., Washington University (Cytology and Taxonomy).

Graduate Apprentices: Louis G. Brenner, B.A., Washington University (Morphology and Geography); Ralph W. Emons, A.B., Washington University (Taxonomy); Stanley Bettoney, B.S., Massachusetts State College (Genetics).

Degrees.—The following students in the Henry Shaw School of Botany received degrees of master of science at the Washington University commencement in June: Ralph E. Rawlings, B.S., University of Arkansas (Mycology and Taxonomy); William L. Brown, B.A., Bridgewater College (Cytology and Taxonomy); Elizabeth Jeannette Heuser, A.B., Washington University (Mycology); Robert W. Schery, A.B., Washington University (Morphology and Taxonomy).

Published Articles.—

Anderson, Edgar: A Survey of Modern Opinion, Bull. Torr. Bot. Club. May, 1940; Notes from the Missouri Botanical Garden Arboretum. Mo. Bot. Gard. Bull. May, and June, 1940; Shading New Transplants with Brush. Real Gardening. March, 1940; Sweet Corn with a College Education. Mo. Bot. Gard. Bull. April, 1940; Two Ozark Wild Flowers for the Fall Garden. Ann. Mo. Bot. Gard. October, 1940; with William L. Brown: Lawns and Lawn Grasses for St. Louis. Mo. Bot. Gard. Bull. September, 1940; and Leslie Hubricht: A Method for Describing and Comparing Blooming-seasons. Bull. Torr. Bot. Club. November, 1940.

Andrews, H. N.: On the Stelar Anatomy of the Pteridosperms with Particular Reference to the Secondary Wood. Ann. Mo. Bot. Gard. February, 1940.

Beilmann, August P.: An Attempt to Record Internal Tree-Trunk Pressures. Ann. Mo. Bot. Gard. September, 1940; The Bald Cypress as a Shade Tree. Mo. Bot. Gard. Bull. June, 1940; Beware the Drought. Mo. Bot. Gard. Bull. October, 1940; Don't Burn the Leaves. Mo. Bot. Gard. Bull. November, 1940; Frost Cracks. Mo. Bot. Gard. Bull. and The Shade Tree. February, 1940; Lightning and Trees. Mo. Bot. Gard. Bull. December, 1940; The Pruning of Shrubs. Mo. Bot. Gard. Bull. March, 1940; Scouting the Short-leaf Pine. Mo. Bot. Gard. Bull. May, 1940; Winter Injury. Mo. Bot. Gard. Bull. April, 1940.

Bettoney, Stanley. Colchinine to Aid the Plant Breeder. Mo. Bot. Gard. Bull. June, 1940.

Brown, William L., and Edgar Anderson. Lawns and Lawn Grasses for St. Louis. Mo. Bot. Gard. Bull. September, 1940; and Robert B. Clark: The Chromosome Complements of *Bumelia lanuginosa.* Amer. Jour. Bot. April, 1940.

Clark, Robert B.: A Hardy Woody Plant New to Horticulture. Mo. Bot. Gard. Bull. December, 1940; with William L. Brown: The Chromosome Complements of *Bumelia lanuginosa.* Amer. Jour. Bot. April, 1940.

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April, 1940. (Reprinted from Garden BULLETIN); Ridding the Garden of Moles. Garden Digest. June, 1940. (Reprinted from Garden BULLETIN); Some Common Plant Pests and Their Control. Real Gardening. August, 1940. (Reprinted from Garden BULLETIN); Winter Storage of Tender Bulbous Plants. Real Gardening. November, 1940.

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Kohl, Paul A.: Chrysanthemums from Start to Finish. Real Gardening. October, 1940. (Reprinted from Garden BULLETIN); Growing and Displaying Chrysanthemums. Gard. Chron. Amer. October, 1940; Hedge Plants for St. Louis. Mo. Bot. Gard. Bull. November, 1940; The Kudzu Vine. Mo. Bot. Gard. Bull. April, 1940; Peonies. Mo. Bot. Gard. Bull. October, 1940; Some Fundamentals of Good Rose Gardening. Real Gardening. December, 1940. (Reprinted from Garden BULLETIN); What Shall We Do with the Christmas Poinsettia? Flower Grower, Garden Digest, and Real Gardening. January, 1940. (Reprinted from Garden BULLETIN).

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Ownbey, Marion. Monograph of the Genus Calochortus. Ann. Mo. Bot. Gard. November, 1940.

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Rawlings, Ralph Edmund. Observations on the Cultural and Pathogenic Habit of *Thielaviopsis basicola* (Berk. & Br.) Ferraris. Ann. Mo. Bot. Gard. November, 1940.

Schery, Robert W., with Robert E. Woodson, Jr.: Contributions Toward a Flora of Panama. IV. Miscellaneous Collections, chiefly by Paul H. Allen. Ann. Mo. Bot. Gard. September, 1940.

Seibert, Russell J.: The Bignoniaceae of the Maya Area. Carnegie Inst. Wash. Publ. No. 522. June, 1940; New Names in Cybistax and Tabebuia. Tropical Woods. September, 1940.

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Scientific and Popular Lectures.—

Dr. Henry N. Andrews, Instructor in Botany, Shaw School of Botany: April 2, Radio Station KSD, "Spring Flowers in Missouri."

Mr. A. P. Beilmann, Arboriculturist to the Garden: March 12, University City Parent-Teachers' Association, "The Tree as a Living Organism"; April 2, Columbine Chapter, Daughters American Revolution, "Conservation and Thrift of Plant Life"; June 3, Building Officials Conference of America, "The Tree as a Living Organism"; August 30, conducted plant clinic at the National Shade Tree Conference, Detroit, Mich.

Mr. Ladislaus Cutak, in Charge of Succulents at the Garden: January 31, Missouri State Growers School, at Hotel Chase, "Along the Cactus Trail"; March 12, St. Pius Holy Name Society, "Foot-loose in Mexico"; March 14, St. Louis Florist Club, "The Quest for Plants in Mexican Deserts"; April 1, St. Louis Ladies' Florist Club, "Cactus Hunting in Texas and Mexico"; May 15, St. Louis Camera Club, May 16, Holy Name Society of St. Boniface Church, and June 21, Married Men's Sodality of St. Anthony Church, "Camera Clicks in Old Mexico"; October 4, St. Louis Horticultural Society, "Plants of Old Mexico'"; October 10, Garden Club, Des Moines, Iowa, "Cacti and Succulents"; November 13, Cooperative Club at Hotel Statler, "Hunting Cacti in Mexico."

Dr. Carroll W. Dodge, Mycologist to the Garden: December 4, School of Medicine of Washington University, "Public Health Problems in Central America."

Dr. David C. Fairburn, Horticulturist to the Garden: February 6, Monday Club of the St. Louis Horticultural Society, "Raising Plants from Seeds"; June 4, St. Clair Garden Club, Belleville, Ill., "Garden Soil."

Mr. L. P. Jensen, Manager of the Garden Arboretum: February 22, Marguerite Krueger Conservation Club, "The Henry Shaw Gardenway"; March 7, Garden Club of Washington, Mo., "Steps in Landscape Design"; April 16, Bourbouse Council, Boy Scouts of America, at Union, Mo., "Nature Study and the Scout"; May 10, amateur gardening classes at the Garden, "Recent Activities in the Development of the Arboretum"; September 27, Tenth District of the Federated Garden Clubs of Missouri, "Roadside Development"; October 12, St. Louis Naturalists' Club, "Old Herbals" and "Naturalists I Have Known"; October 16, Wright Garden Club of St. Louis County, "The Missouri Botanical Garden Arboretum"; October 19, Missouri Valley Chapter of American Society of Landscape Architects, "The Missouri Botanical Garden Arboretum" and "The Henry Shaw Gardenway."

Mr. Paul A. Kohl, Floriculturist to the Garden: January 31, Missouri State Growers School, at Hotel Chase, "The Missouri Botanical Garden"; February 6, Ladue Garden Club, "Roses"; March 26, Garden Club, Hannibal, Mo., "The Missouri Botanical Garden"; April 2, St. Louis Hills Garden Club, "Roses"; May 16, Neighborhood Association, two reels of colored pictures depicting "Spring and Summer in the Missouri Botanical Garden"; November 25, Station KSD, Adult Education Council program, "The Chrysanthemum Show and Other Floral Displays."

Dr. George T. Moore, Director of the Garden: February 12, Junior League lecture course, "What's New in the Plant World—If Anything"; March 7, St. Louis Women's Club, "California vs. Missouri, Horticulturally Speaking"; April 22, Delta Gamma Mothers' Club, "Keeping Up-to-Date in the Garden"; October 8, over Station KWK, "Orchids"; November 30, Science Teachers' Section of the Private Schools Association of the Central States; December 4, Station KFUO, "Henry Shaw, Prophet and Philanthropist"; December 6, Oklahoma Academy of Science, Norman, Okla., "On Being Scientific"; December 11, Station KFUO, "Botanical Gardens Yesterday and To-Day."

Mr. George H. Pring, Superintendent of the Garden: January 19, Optimists' Club, "Romance of the Plant World"; January 22, Kirkwood Garden Club, "Plant Reproduction"; March 1, St. Louis Horticultural Society, and March 7, Tyler Place Presbyterian Church, "The Garden Floral Displays Throughout the Year," with Mr. Kohl's colored slides; March 5 and 8, Radio Station KMOX, March 9, Radio Station KSD, March 13, KXOK, "St. Louis Flower Show"; March 28, Friendly Fellows Club of Shaw Avenue Methodist Church, "Hybrid Tropical Water-lilies"; April 5, at tree-planting ceremonies, Fairground Park; May 20, over Station KWK, "What to Plant in the Garden"; June 11, graduating address at the Lindenwood Public School; June 13, Optimists' Club, Granite City, Ill., "The Romance of Plant Life"; October 15, Coterie Club, at the Hotel Kingsway, "The Missouri Botanical Garden"; October 24, Marguerite Krueger Conservation Club, "Conservation"; November 7, Parent-Teachers' Association of the Twillman School, "Jungle Experiences in the Andes of South America"; November 13, Granite City Community High School, "Floral Displays Throughout the Year"; November 16, Pi Beta Phi Fraternity of the University of Illinois, "Collecting Orchids in the Andes of South America"; December 1, Men's Club, Tyler Place Presbyterian Church, "Breeding of Tropical Water-lilies."

Mr. Russell J. Seibert, Washington University Fellow in Botany: April 17, Mascoutah Women's Club, "Spring Comes to the Arnold Arboretum"; June 5, North St. Louis Real Estate Salesmens' Association, "Panama."

Dr. Hermann von Schrenk, Pathologist to the Garden: November 6, Wednesday Club of St. Louis, "Pacific Coast Trees."

HERBARIUM

The herbarium has continued its regular activities throughout the year and marked progress has been achieved. The most outstanding item to record is the expansion of the herbarium. This was made possible by the addition of a relatively large block of new steel cases which were installed late in 1939 on the second and third floors in the south end of the office building. The expansion necessitated shifting of practically the entire herbarium;

but thereby the congested condition has been relieved, and the additional case-capacity gained is sufficient to accommodate a normal growth of the herbarium for a period of approximately five years. This rearrangement of the collections was effected without materially interfering with the regular use of the herbarium for comparative and special studies.

Several important gifts have been received during the year. The most noteworthy of these is the bequest of the late Professor J. Andrew Drushel, formerly of St. Louis but for the past twenty years of New York University. It is estimated that the Drushel collections consist of approximately 10,000 specimens of plants, mainly from the eastern half of the United States. Since only about one-half of the Drushel Herbarium has been received actual figures are not included in this year's report.

Another appreciated gift is that of Mr. H. C. Irish, who for several years was connected with the Missouri Botanical Garden, now associated with the St. Louis Public Schools. This collection consists of flowering plants and fungi, collected in the vicinity of Ames, Iowa, in the early nineties.

The major series of plants acquired during the year are here assembled, even though most of them, with other current accessions, have been recorded in the monthly issues of the Garden BULLETIN.

New Accessions.—Elizabeth Ammerman, 60 plants of Texas; Edgar Anderson, 81 plants of central United States and of horticulture; H. N. Andrews and G. T. Johnson, 208 fungi of southern United States; Arnold Arboretum, 2,639 plants of Asia, India, North and Central America; Avenue Camera Store, 54 photographs of type specimens; J. T. Baldwin, Jr., 52 specimens of *Galax* from southeastern United States; R. W. Baxter, 134 plants of the Hawaiian Islands; Mrs. H. P. Bracelin, 712 plants of Mexico and South America; Brooklyn Botanic Garden by H. K. Svenson, 211 plants of Tennessee; Bureau of Plant Industry, National Arboretum, 1,470 plants of western United States and Mexico; Carnegie Museum, 144 plants of Newfoundland; Albert Chandler, 55 plants of eastern and central United States; E. E. Cheesman, 25 plants of Trinidad and Tobago; Robert B. Clark, 80 plants of Illinois, Oklahoma, and Texas; Ira W. Clokey, 3,211 plants of

Nevada and California; William Bridge Cook, 70 "Mycobiota of North America"; Arthur Cronquist, 625 plants of Idaho and Utah; Hugh C. Cutler, 364 plants chiefly of the southern United States; Otto Degener, 194 plants of the Hawaiian Islands; Duke University, 170 plants chiefly from southeastern United States; Mary Taylor Edwards, 603 plants of Mexico; Carl C. Epling, 94 published illustrations of *Salvia;* Walter J. Eyerdam, 255 plants of Alaska; Field Museum of Natural History, 867 plants of Mexico, Central and South America, and 1,054 photographs of type specimens; Howard Scott Gentry, 930 plants of Mexico; Frank W. Gould, 44 specimens of *Camassia* from the Northwest; Gray Herbarium of Harvard University, 1,756 plants of the United States, Mexico, etc.; J. M. Greenman, 25 plants of Illinois and Missouri including photographs of type specimens; John Hancin, 32 plants of Kansas; George B. Hinton, 600 plants of Mexico; New York College of Agriculture, 102 plants of Washington; R. M. Harper, 118 plants of Alabama; F. J. Hermann, 74 plants chiefly from Georgia; A. C. Herre, 39 lichens of California; Harry Hoogstraal, 797 plants of Mexico; Leslie Hubricht, 493 plants of central and southern United States; Instituto Miguel Lillo, 357 plants of Argentina; Iowa State College, 927 plants of Iowa, Oklahoma, and Arizona; H. C. Irish, 88 plants of Iowa; L. A. Kenoyer, 75 plants of Mexico; Mrs. H. B. Looff, 97 plants of Kodiak Island, Alaska; C. L. Lundell, 439 plants of Mexico and Central America; Harold N. Moldenke, 565 plants of eastern United States; W. A. Murrill, 1,157 plants of Florida; H. B. Parks and R. H. Peebles, 31 plants of Texas and Arizona; Philadelphia Academy of Natural Sciences, 75 plants of eastern United States; M. P. Porsild, 32 plants of Greenland; A. E. Ragonese, 30 plants of Argentina; Rancho Santa Ana Botanic Garden, 29 plants of California; P. O. Schallert, 407 plants of North Carolina; Russell J. Seibert, 494 plants of Florida and of horticulture; Alexander F. Skutch, 254 plants of Costa Rica; J. Smarods, 46 fungi of Latvia; A. C. Smith, 43 plants of Bolivia; State College of Washington, 149 plants of northwestern United States; Mrs. R. A. Terry, 297 plants of Panama; United States National Museum, 588 plants of the United States and South America; University of California, 645 plants of Alaska and California;

University of Colorado Museum, 24 specimens of *Senecio* from Colorado; University of Kentucky, 200 plants of Kentucky; University of Michigan, 191 plants of Colorado, Mexico, and Central America; University of Minnesota, 329 plants of Minnesota; University of Pennsylvania, 215 plants of Virginia; University of Wisconsin, 154 plants of Wisconsin; Hermann von Schrenk, 141 plants chiefly from Texas; L. O. Williams, 100 orchids of Mexico; R. E. Woodson, Jr., 4,796 plants of Panama.

Mounting and Insertion of Specimens.—The mounting of specimens has been pushed forward as rapidly as possible. The regular mounter, Mrs. L. Cherney, has worked conscientiously and effectively throughout the year. To facilitate the mounting Mr. A. R. Gordon, a graduate student, was employed during the summer months; and some assistance was obtained through employment of NYA undergraduate students of Washington University. Mrs. Edward C. Berry and Mr. D. Flint also assisted for a limited time in the mounting and insertion of lichens and fungi. Although this extra service has greatly expedited the routine of mounting and distribution it has been impossible to keep apace with the acquisition of new material. The insertion of newly mounted plants in the organized herbarium has devolved primarily on Miss Maude Lodewyks and Mr. Edward C. Berry, who have rendered valuable service in this capacity, as well as in general herbarium work.

Exchanges.—The unsettled conditions in Europe and the disturbed transportation facilities have made it necessary to discontinue temporarily all international exchanges of herbarium material. Notwithstanding this unfortunate situation the herbarium has received during the year from individual correspondents and scientific institutions in America 15,440 specimens. In the same period 7,909 specimens have been sent to correspondents. A relatively large proportion of these exchanges has been with South American correspondents with whom mutual interests are rapidly increasing.

Field Work.—A fair amount of field work has been carried on during the year by members of the staff and by graduate students majoring in taxonomy.

During the months of June, July, and August, Dr. R. E. Woodson and Mr. Robert W. Schery collected somewhat over 1,000 numbers of vascular plants in Panama, particularly in the high mountains of Chiriquí. Other extensive collections of vascular plants were made under the auspices of the Garden by Paul H. Allen, Peggy and Gene White, and H. von Wedel. Mr. Leslie Hubricht has made noteworthy collections of non-vascular and vascular plants in central and southern United States. A very interesting series of fungi was collected in the southern states by Drs. H. N. Andrews and George T. Johnson. Dr. Hugh C. Cutler also made a relatively large collection of plants in the western and southwestern states. Mr. Russell J. Seibert spent several weeks in Florida and obtained a good representation of the winter flora of that state. Notable also are the collections of Dr. E. Anderson from a wide geographical range within the United States, and the collections of *Bumelia* by Mr. Robert B. Clark in Oklahoma and Texas.

Alumni and present graduate students of the Shaw School of Botany have continued to donate small collections from different parts of the country. These smaller collections are frequently of importance in adding to our knowledge of particular species, especially in connection with variation and geographical distribution.

Use of the Herbarium.—The herbarium continues to perform a service to an ever-increasing number of laymen, amateurs, teachers, and professional botanists from all parts of the country. The number of specimens loaned to institutions for research study by graduate students and for monographic study by specialists is considerably in excess of any previous year for the past twenty-five years. The routine work involved in drawing out from the herbarium specimens for loans, the making of necessary records, and the replacement of such material in the herbarium on its return requires extreme care and considerable time.

Groups of Plants under Special Study.—An intensive study of several groups of plants has been under way during the year. Some of these are as follows: Bignoniaceae by Russell J. Seibert; *Bumelia* by Robert B. Clark; *Clematis* (section *Viorna*) by Ralph O. Erickson; *Dalea* by Elizabeth Ammerman; *Malvaviscus* by Robert W. Schery; *Krameria* by Dorothy Henson; Gramineae, especially *Poa,* by William L. Brown; *Smilacina* of Mexico and

Central America by Ralph W. Emons; *Ephedra* and Gramineae, particularly *Tripsacum* and its immediate allies, by Hugh C. Cutler; Apocynaceae and Asclepiadaceae by Robert E. Woodson, Jr.; lichens by C. W. Dodge and E. C. Berry; and Compositae by J. M. Greenman.

Statistical Summary (for the year ending December 31, 1940):

Number of specimens received during 1940:		
By purchase	7,052	
By gift	4,570	
By exchange	15,440	
By transfer	13	
By field work	3,978	
Total	31,053	
Number of specimens mounted and incorporated in 1940		24,055
Number of specimens carried forward from 1939		1,303,847
Total		1,327,902
Number of specimens discarded in 1940		7
Total number of specimens in herbarium		1,327,895

LIBRARY AND PUBLICATIONS

No one acquainted with conditions in a scientific library would expect a very glowing report for the year 1940. Moreover, the Garden library is particularly affected since it has always been known for its collection of foreign serials. As late as June, European shipments were still being received, although some were dated months back. Since then only the English publications have come in with regularity, and the regularity with which they are received is remarkable. Apparently not one number of the weekly periodical *Nature* is missing, nor of the monthly *Bulletin Miscellaneous Information of the Royal Botanic Gardens, Kew.* Some of the continental European journals are being held by our subscription agent at The Hague, pending return to more normal conditions, but their status is, of course, uncertain.

In regard to the publications received in exchange for the ANNALS and BULLETIN, the Foreign Exchange Service of the Smithsonian Institution is now refusing shipments to every European country except Finland and the Soviet Republics; in Asia, China and Palestine are not accepted; and in Africa, Egypt.

Since those sent to the African and Asiatic colonies go through European capitals, they are also eliminated. Naturally the service works both ways, and we are not receiving journals from any of the above-mentioned countries. From about 1,200 foreign publications received annually in 1928, the number received in their entirety for 1940 was probably less than 500.

The bright side of the picture is that more interest is being shown in things close at home. In recent years people have apparently turned to gardening as never before, and the gardening public in St. Louis is "finding" the Missouri Botanical Garden library. This may be due to the influence of garden clubs or of one person telling another who tells another, but regardless of the cause a day never passes but what some enthusiastic plant grower makes use of the Garden library.

One very important service which the Garden was able to give to the plant-lovers of Missouri during the last year was the coöperation with the Field Museum, Chicago, in the publishing of Steyermark's *Spring Flora of Missouri.* While the Garden is justly proud of this accomplishment it is not necessary for us to say anything in its favor. The readers have already done that for us, and following are a few excerpts from some of the reviews of the book:

> "This book acquaints the people of Missouri and surrounding states with all wild flowers in bloom by June. The author has put the descriptive matter in language easily understood by the layman." *Scientific Monthly.*
>
> "Here is a book that is complete. . . . It contains the name, with annotated material, of every wild flower that is known to bloom in Missouri before June 1—about 1,400 different flowers. . . . Undoubtedly this is the book Missouri flower-lovers have been looking for." *Missouri Historical Review.*
>
> "Written in a language which anyone can understand (though with an accuracy which requires the inclusion of some technical matter), and abundantly illustrated with line drawings, the *Spring Flora* includes the more than 1,400 species which flower in Missouri before the first of June." *Garden Life.*
>
> "Of most general value in Missouri and all this section of the Middle West is Julian Steyermark's comprehensive *Spring Flowers of Missouri.* . . . The major purpose of Mr. Steyermark's book is identification, and for this purpose he has adapted to the needs of the amateur plant hunter, the analytical key often used in more advanced works." *Kansas City Star.*

"It is the most comprehensive spring flora ever issued for any state. . . . The book is notable for presenting its data in simple non-technical English, yet with thorough scientific accuracy. Thus it satisfies the needs both of the lay reader and the scientist. Most of the plants described and illustrated are found in Illinois and adjacent states, so the book's value is not limited to Missouri." *Field Museum Notes.*

"A new volume, *Spring Flora of Missouri*, is a complete and accurate guide to our state's wild flowers, written by a Missourian who really knows native plant life. . . . The author is thorough and accurate and 'knows every plant from the time it first peeps out of the ground until it becomes dry and withered.' The book should prove of real worth to horticulture chairmen throughout the state in the compilation of native plant information."
Garden Forum.

"In the preface the author plainly states, 'This book is intended for use of everyone interested in plants, particularly the beginner. Its purpose is to acquaint the people of Missouri and surrounding states with the native flowers, which are in bloom on or before June 1.' In this the author has succeeded admirably. . . . The book should be of great use to local garden clubs and others who take an interest in such matters as well as for the more serious students. For the scientific worker who is concerned with the local flora, it should be invaluable."
National Horticultural Magazine.

"The spring flowers of Missouri have found a chronicler in Julian A. Steyermark. In a book of nearly 600 pages, he has recorded all the plants that blossom before the first of June, with the exception of the grasses and sedges. . . . A desirable innovation is the use of small line drawings in the keys which enable the students to understand technical terms better than any written definition could. The book is certain to be of great help to all students of the Missouri flora." *American Botanist.*

"In comparison with available books of similar nature, the *Spring Flora of Missouri* stands out at once. . . . Apparently the author has spared neither time nor effort in its preparation and one almost regrets that the book was not expanded into a 'Flora of Missouri.' . . . The numerous illustrations, habit sketches as well as diagrams . . . are likely to contribute materially to the popularity of the book. Fortunately, the names used are those gleaned from the most recent revisions and monographs. . . . In short, the book is the best 'Spring Flora' available at present in the United States."
American Midland Naturalist.

"In his *Spring Flora of Missouri*, Dr. Steyermark has brilliantly succeeded in combining simplified terminology with precise scientific accuracy and authoritativeness. . . . Along with the concise, non-technical descriptions of each species, Dr. Steyer-

> mark has occasionally included information regarding poisonous properties . . . and he has even suggested detailed remedies. Such added notes serve to make the book of greater value and interest to the layman. . . . The *Spring Flora* is carefully and critically done, so that it should find wide and enthusiastic reception at the hands of all those amateurs and professionals alike, who enjoy being acquainted with the rich native flora of Missouri. Indeed, this book may well pave the way for more comprehensive state or regional manuals, written in a less technical fashion than has been adhered to heretofore, without a loss of scientific accuracy. *Rhodora.*

The work of shifting and cleaning the books in the basement is being continued, but the progress has been slower than had been expected. The reason for this is that since the discontinuance of the position of telephone operator the library staff have been operating the switchboard.

Publications.—In addition to Steyermark's *Spring Flora,* the four numbers of Volume XXVII of the quarterly ANNALS and Volume XXVIII of the monthly BULLETIN were issued during the year. The ANNALS contains 606 pages, 44 plates, and 34 text-figures; the BULLETIN, 236 pages, 19 plates, and 36 text-figures.

The September BULLETIN, by Mr. William L. Brown and Dr. Edgar Anderson, was devoted to the lawn-grass problem in St. Louis, and judging from the response of the public filled a long-felt need. In anticipation of the demand 500 copies over the regular edition were printed, and all but about 50 were sold in six weeks. Furthermore, this September issue called the BULLETIN to the attention of the people of St. Louis, and 30 new annual subscriptions followed its publication.

Five years ago the Garden printed a set of eight colored post-cards, representing views of the Garden, to be sold to visitors. In December, 1940, the supply was exhausted, and another edition was immediately printed. These are on sale at the Main Gate.

In August 512 reprints from the Garden ANNALS were sent to 216 botanists and institutions, many important publications being received in exchange for these. The Garden publications are also sent on subscription, and the total receipts for the year for ANNALS, BULLETINS, reprints, post-cards, etc., were $2,328.70.

Accessions.—European book firms, especially the English ones, continue to send their catalogues. Often valuable findings are listed, but it so happens that few of the Garden's *desiderata* have been advertised. Several books, however, were ordered from abroad and have been received. A number of books have also been purchased from American dealers and, while unimportant in themselves, help to complete gaps in our collection. Many reprints and worth-while books are also received as gifts. Following is a partial list of some of the more outstanding accessions in 1940: Adanson, M. A voyage to Senegal, the Isle of Goree, and the River Gambia. 1759; The Badianus manuscript. An Aztec herbal of 1552. Introduction, translation and annotations by Emily Walcott Emmart. 1940; Buist, Robert. The American flower garden directory . . . 1841; Bush-Brown, Louise and James. America's garden book. 1939; Conzatti, C. Flora taxonomica Mexicana. Partes I, II. 1939; Deam, Charles C. Flora of Indiana. 1940; Dickson, James G. Outline of diseases of cereal and forage crop plants of the northern part of the United States. 1939; Earnest, Ernest. John and William Bartram. 1940; Fassett, Norman C. A manual of aquatic plants. 1940; Gardner, George. Travels in the interior of Brazil . . . during the years 1836-41. 1846; Grove, Arthur. A supplement to Elwes' monograph of the genus Lilium. Part VII. 1940; Hall, A. Daniel. The genus Tulipa. 1940; Hoehne, F. C. Plantas e substancias vegetais toxicas e medicinais. 1939; Huxley, Julian. The new systematics. 1940; Johow, Federico. Estudios sobre la Flora de las Islas de Juan Fernandez. 1896; Lamarck, Jean Baptiste . . . Flore francoise . . . Vols. 1-3. 1778; Lemée, A. Dictionnaire descriptif et synonymique des genres plantes phanerogames. Vol. VII. 1939; McFarland, J. Horace. Modern roses. II. 1940; Mackenzie, K. K. North American Cariceae. Vols. 1-2. 1940; Parry, William Edward. Journals and narratives of his four voyages for discovery of the Northwest Passage, 1819-27, with the appendices to the first and second voyages, also the supplement to the appendix to the first voyage. 6 vols. 1821-28; Pfeiffer, Hans H. Experimental cytology. 1940; Rehder, Alfred. Manual of cultivated trees and shrubs. 1940; Société des sciences naturelles de Neuchâtel. Memoires. Vols. 1, 2, 3, 4, pts. 1 and 2. 1835-1874; Spencer, E. R. Just weeds. 1940; Weber, George Heinrich. Primitiae florae Holsaticae, and supplement. 1780-1787. Facsimile ed. 1925.

Visitors.—In addition to the staff and students in the Henry Shaw School of Botany, the following out-of-town botanists or horticulturists have consulted the Garden library during the year: Prof. O. S. Aamodt, of the U. S. Dept. Agr., Washington, D. C.; The Hon. George D. Aiken, Governor of Vermont, and authority on horticultural subjects; Dr. F. A. Barkley, Instructor in Botany, University of Montana; Mr. Paul H. Allen, Garden's Representative in Tropics, Balboa, C. Z.; Dr. John T. Buchholz, Head, Department of Botany, University of Illinois; Mr. Karl Busch, Horticulturist, University of Indiana; Dr. Elzada U. Clover, Instructor in Botany, and Assistant Curator Botanical Gardens, University of Michigan; Dr. Hugh C. Cutler, Botanical Collector, Santa Fe, New Mexico; Dr. F. F. Davis, Botanist, U. S. Golf Association, Washington, D. C.; Mr. Ralph Emerson, Instructor in Botany, University of California; Dr. Carl C. Epling, Associate Professor of Botany, University of California, Los Angeles; Mr. Edgar L. Evinger, of the Soil Conservation Service, Washington, D. C.; Mr. Louis Fourt, Graduate Student in Genetics, University of Missouri; Dr. Harry J. Fuller, Assistant Professor of Botany, University of Illinois; Dr. George J. Goodman, Assistant Professor of Botany, Iowa State College, Ames; Mr. C. J. Gould, Instructor in Botany, Iowa State College, Ames; Dr. Leon Grodsinsky, Division de Fitopatologia, Ministerio de Agricultura, Buenos Aires, Argentina; Dr. George B. Happ, Assistant Professor of Biology, Principia College, Elsah, Ill.; Mr. Leroy H. Harvey, Research Assistant, Botanical Gardens, University of Michigan; Mr. Howard Harris, Graduate Student, University of Missouri; Miss Ruth Hawkins, Graduate Student in Botany, University of Illinois; Sir George F. Huggins and Major W. Knaggs, orchid fanciers, of Trinidad, B. W. I.; Miss Lois Jotters, Graduate Student in Botany, University of Michigan; Mrs. Vincent Kolkmeyer, Botanist, Missouri Research Museum, Jefferson City; Dr. Maxine Larisey, Assistant Professor of Biology, Judson College, Marion, Alabama; Dr. Catharine M. Lieneman, Assistant Professor of Botany, Wisconsin State Teachers' College, River Falls; Mr. William C. Leavenworth, Assistant in Botany, University of Illinois; Mr. Albert L. Little, Jr., of the U. S. Forest Service, Flagstaff, Ariz.; Dr. Albert J. Mangelsdorf, Chief Geneticist, Hawaiian Sugar Planters' Association, Honolulu; Dr. Paul C.

Mangelsdorf, Professor of Economic Botany, Harvard University; Mr. John Marr, Teaching Assistant, University of Minnesota; Miss Elizabeth A. Meredith, of the Wm. C. Meredith Co., Wood Preservers, Atlanta, Ga.; Mr. Emery Moore, Graduate Student, Gray Herbarium of Harvard University; Dr. Harold Morrison, of the Bureau of Entomology and Plant Quarantine, U. S. Dept. Agr., Washington, D. C.; Dr. Carlos A. O'Donell, of the Instituto Lillo, Tucuman, Arizona; Dr. F. W. Pennell, Curator of Plants, Academy of Natural Sciences, Philadelphia; Dr. C. Audrey Richards, Pathologist, Forest Products Laboratory, U. S. Dept. Agr., Madison, Wis.; Mrs. Edward Rodeman, of the Jefferson City Garden Club, Jefferson City, Mo.; Mr. George B. Rossbach, Graduate Student, Leland Stanford University, Stanford, Calif.; Dr. John B. Routien, Instructor in Botany, University of Missouri; Dr. A. P. Saunders, Professor of Chemistry, Hamilton College, Clinton, N. Y., and a director of American Peony Society; Dr. Henry Schmitz, Dean of School of Forestry, University of Minnesota; Miss Bernice G. Schubert, Technical Assistant and Graduate Student, Gray Herbarium of Harvard University; Dr. Paul B. Sears, Head, Department of Botany, Oberlin College, Oberlin, Ohio; Dr. Julian F. Smith, Associate Director, Hooker Scientific Library, Central College, Fayette, Mo.; Mr. H. A. Stevenson, U. S. Soil Conservation Service, Elsberry, Mo.; Dr. Julian A. Steyermark, Assistant Curator of Herbarium, Field Museum of Natural History, Chicago; Prof. Robert Stratton, Associate Professor of Botany and Plant Pathology, Oklahoma Agricultural and Mechanical College, Stillwater; Mr. Stanley A. Watson, Graduate Student in Plant Physiology, University of Illinois; Dr. Robert W. Webb, Principal Cotton Technologist, Bureau of Agricultural Economics, U. S. Dept. Agr., Washington, D. C.; Dr. Louis Wheeler, Instructor in Botany, University of Missouri; Mr. William F. Wight, of the Division of Horticultural Crops and Diseases, U. S. Department of Agriculture, Palo Alto, Calif.; Mr. Thurman Wilkins, of the Huntington Gardens, San Marino, Calif.; Dr. F. Lyle Wynd, Assistant Professor of Botany, University of Illinois; Miss Patricia Young, Graduate Student, University of Kentucky, Louisville.

Among the groups visiting the Garden library during 1940 were: the botany class of Junior College, Moberly, Mo., accompanied by Miss Esther Adams; botany class of Southern Illinois State Normal University, Carbondale, Ill., Prof. Walter B. Welch in charge; Dr. Harry J. Fuller, Assistant Professor of Botany, University of Illinois, with his class in economic botany; class of 20 botany students from University of Missouri, in charge of Dr. William B. Drew, Assistant Professor of Botany, and Dr. Louis C. Wheeler, Instructor in Botany.

The library also loans books on the interlibrary loan plan, 166 such loans having been made to 33 institutions during the year.

Statistical Information.—There have been donated to the library or received in exchange during the year 461 books valued at $1,259.01 and 1,356 pamphlets valued at $205.55. One hundred and eighty-seven books were bought at a cost of $1,154.36, and 22 pamphlets at a cost of $27.89. The library now contains 54,018 books and 85,586 pamphlets. There are 349 manuscripts valued at $1,709.70 and 1,069,682 index cards valued at $13,429.43. A total of 7,238 cards were added during the year, of which 1,201 were written by Garden employees, and 6,037 were purchased at a cost of $132.39. One hundred and sixty-eight books were bound.

ANNUAL BEQUESTS

The annual flower sermon "On the wisdom and goodness of God as shown in the growth of flowers, fruits, and other products of the vegetable kingdom," provided for in the will of Henry Shaw, was preached at Christ Church Cathedral, on April 28, by the Rt. Rev. William Scarlett, Bishop of Missouri.

The Gardeners' Banquet Fund was used to provide turkeys for employees at Christmas.

ATTENDANCE FOR 1940

(Not including visitors to Arboretum)

	Week-days	*Sundays*
January	3,984	7,070
February	7,360	8,026
March	10,136	14,286
April	11,328	9,333
May	23,838	18,417

June	20,388	11,084
July	21,246	8,383
August	25,101	10,062
September	18,868	13,764
October	20,068	16,229
November	17,877	23,183
December	6,851	7,046
	187,345	146,883
		187,345
Total		334,228

George T. Moore,
Director.

STATISTICAL INFORMATION FOR DECEMBER, 1940

Garden Attendance:

Total number of visitors	13,897

Plant Accessions:

Total number of plants and seed packets received as gifts	295

Library Accessions:

Total number of books and pamphlets bought	6
Total number of books and pamphlets donated	121

Herbarium Accessions:

By Purchase—	
Hoogstraal, Harry—Plants of Mexico collected by William Leavenworth	323
By Gift—	
Anderson, Edgar—*Antennaria* sp. from South Dakota	1
Arnold Arboretum—*Juniperus Sabina* L. from horticulture	1
Chandler, Albert—Plants of central United States	13
Cheesman, E. E.—Plants of Trinidad and Tobago	25
Davis, R. J.—Plants of Idaho	7
Gould, Frank W.—*Camassia* from the Northwest	44
Harper, Roland M.—Plants of Alabama	60
Hubricht, Leslie—Plants of Arkansas	6
Lundell, C. L.—Apocynaceae and Asclepiadaceae from Texas	39
Rosengurtt, B.—Plants of Uruguay	18
von Schrenk, Hermann—Plants of Texas	15
By Exchange—	
Clokey, Ira W.—Plants of Nevada and California	3,207
Duke University—Plants chiefly of the southeastern states	170
Herre, A. C.—Lichens of California	39
Total	3,968

STAFF
OF THE MISSOURI BOTANICAL GARDEN

THE GARDEN, 2315 TOWER GROVE AVENUE, ST. LOUIS, MISSOURI

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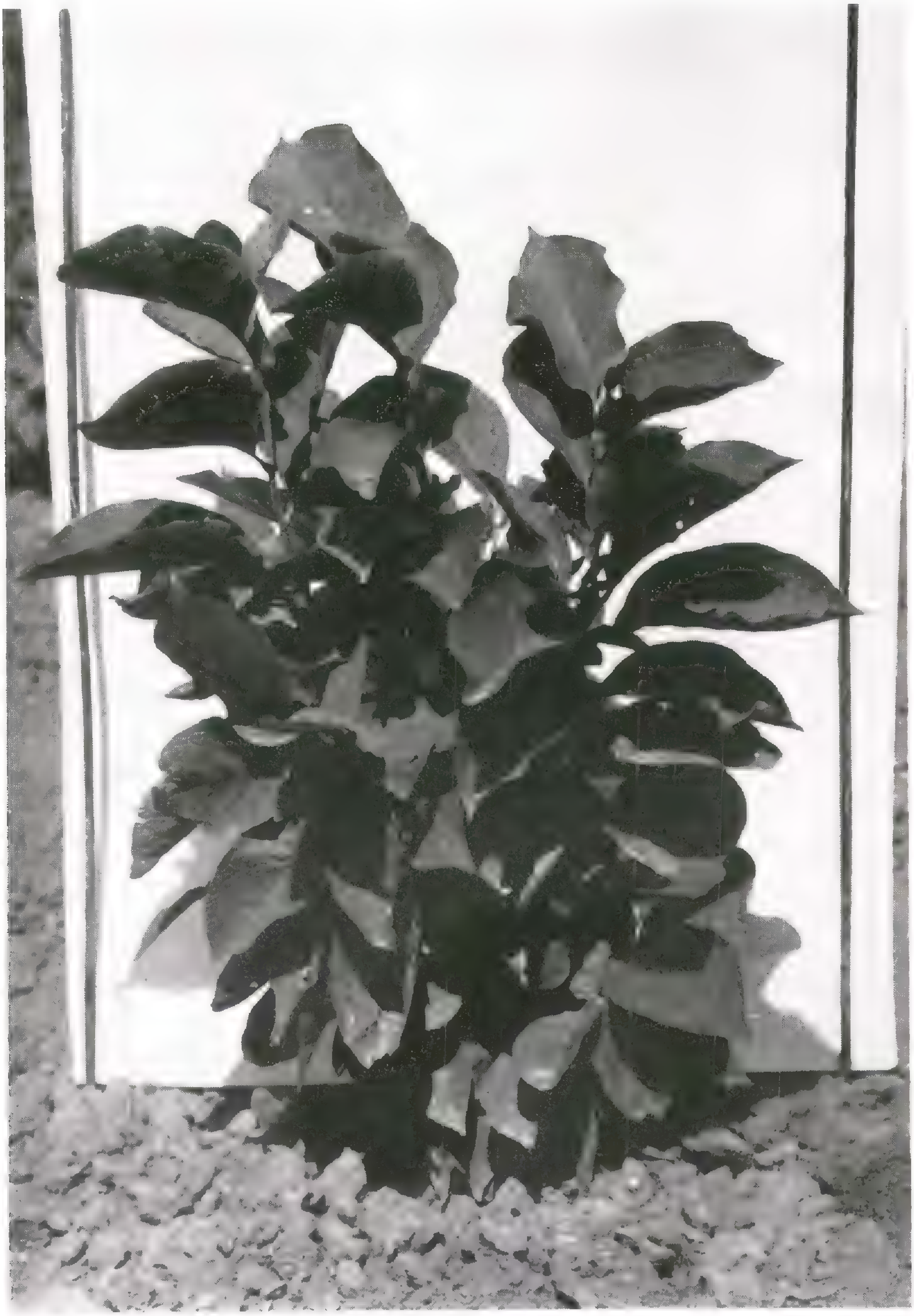
SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date to the death of Mr. Shaw, in 1889, the Garden was maintained under the personal direction of its founder, and while virtually a private garden it was, except at certain stated times, always open to the public. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was designated by Mr. Shaw as its official title and in his will and all of his writings he specifically referred to it as the "Missouri Botanical Garden." By a provision of Mr. Shaw's will the Garden passed at his death into the hands of a Board of Trustees. The original members of the Board were designated in the will, and the Board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provison of the will, the immediate direction of the Garden is vested in a Director, appointed by the Board of Trustees. The Garden receives no income from city or state, but is supported entirely from funds left by the founder.

The city Garden comprises 75 acres, where about 12,000 species of plants are growing. There is now in process of development a tract of land of over 1,600 acres outside the city limits which is to be devoted to (1) the propagation and growing of plants, trees, and shrubs, designed for showing either indoors or outside, at the city Garden, thus avoiding the existing difficulties of growing plants in the city atmosphere; (2) gradually establishing an arboretum as well as holding a certain area as a wild-flower reservation, with the idea that possibly at some future time this may become the new botanical garden.

The Garden is open to the public every day in the year except New Year's Day and Christmas—week days from 8:00 a. m. until sunset; Sundays from 10:00 a. m. until sunset. The greenhouses are closed every day at 5:00 p. m.

The main entrance to the Garden is located at Tower Grove Avenue and Flora Place, on the Sarah car line (No. 42). Transfer south from all intersecting lines.



MAGNOLIA SOULANGEANA, THREE YEARS OLD, GROWN FROM SEED

Missouri Botanical Garden Bulletin

Vol. XXIX FEBRUARY, 1941 No. 2

RAISING MAGNOLIAS FROM SEED

For several years magnolias in variety have been raised from seed collected at the Garden. The results continue to be so favorable that amateurs who prefer to "grow their own" will find the cultural method discussed here an effective way to build up a generous supply of magnolias at small expense.

In St. Louis the early spring-flowering magnolias, *M. stellata* and *M. Soulangeana,* do not form seed regularly due to late frosts which often destroy the blooms. *M. glauca* and *M. acuminata,* which flower in May and June, nearly always produce plenty of seed. *M. grandiflora* does not thrive here and has developed seedpods only once in the past ten years.

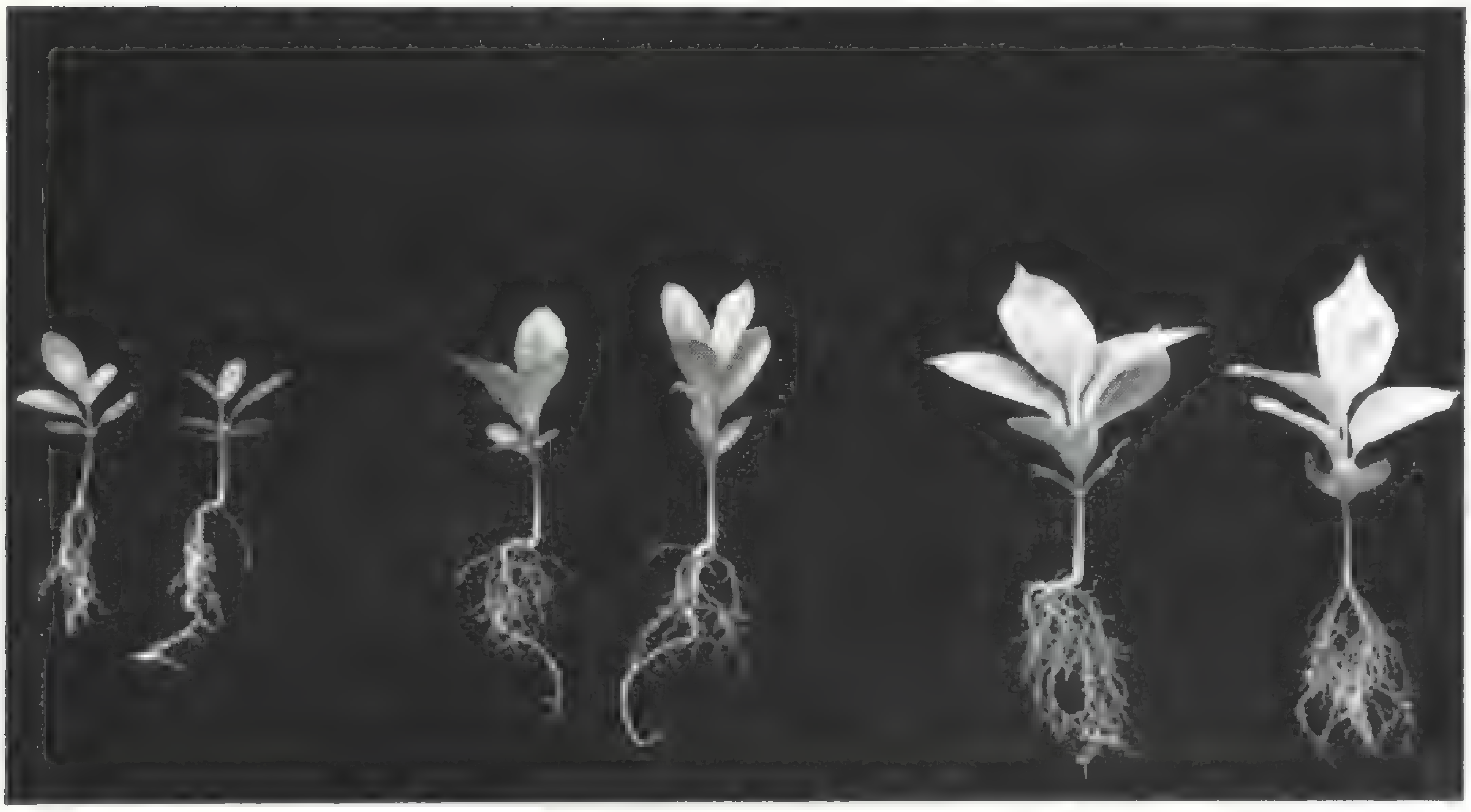
The seed forms in cone-like pods at the tips of the branches. Each well-developed pod contains about two or three dozen seeds. When the pods start to split open, they should be removed from the plant without delay; otherwise the seeds soon drop to the ground and may be lost or eaten by the squirrels and birds. In Missouri this critical time occurs from around August 15 to September 15, the exact date depending on the species and weather conditions. Do not store freshly picked pods in paper bags, boxes or other closed containers, as they are apt to get moldy. Spread the pods out in a warm, dry place for about one week, then the seeds can be easily removed.

When the seeds are taken from the pods, they are still protected by a rubbery covering or pulp that must be peeled off. To do this, soak the seeds in warm (80° F.) water for several hours and then either pit them as you would cherries, or rasp off the pulp by rubbing over window screening. Rinse off the loose pulp with water and rub the seeds well with scouring powder to remove all traces of oiliness. A final wash in cold water completes the cleaning process.

Some seeds germinate best immediately after ripening, whereas others require a rest period of several weeks or months before they will sprout. Holly seeds may lie dormant in soil for one and a half years before they show any sign of life. Magnolia seeds germinate best when given a rest period of several months outdoors buried in moist sand or soil and exposed to freezing temperatures. This process, known as stratification, seems to be essential for the germination of seeds of many perennials, particularly of the alpine plants. We have found that clean sand is the best material in which to stratify magnolia seeds as they are easily separated from the particles of sand. If buried in soil, the seeds are often hard to find. It is more convenient to put the seeds in small flower pots or boxes filled with sand rather than directly in the open ground. Cover the pots with wire netting (½-inch mesh) to keep out squirrels and mice. The sand should be slightly moist before storing the pots in a cold-frame or in a trench outdoors for the winter. Cover with an inch or two of sandy soil, peat or leaf-mold and forget about them until early spring.

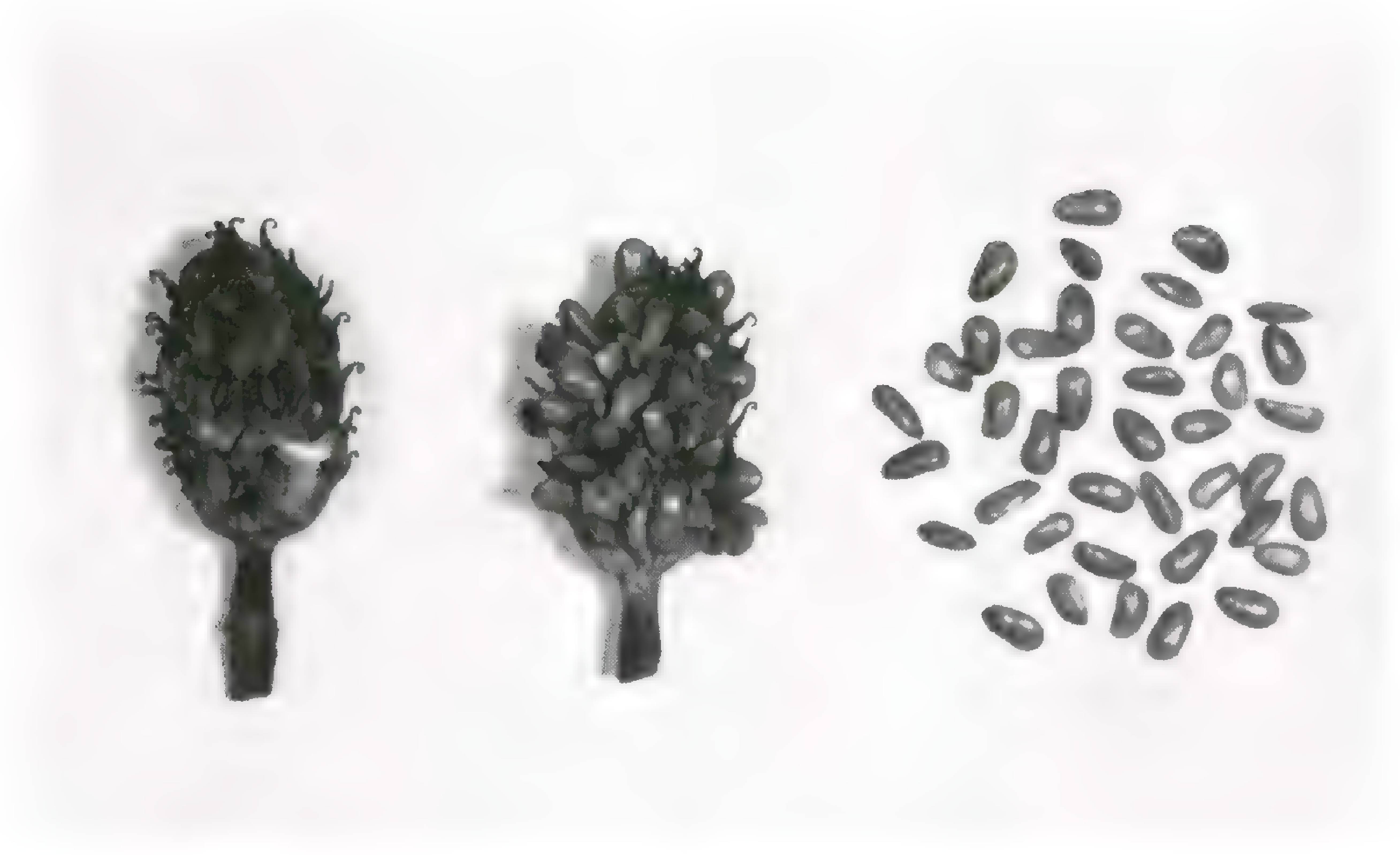
About the middle of April the seeds should begin to germinate. First, the seed-coats split and then the roots start to develop. When these symptoms of growth are clearly evident, it is time to take the seeds out of the sand and replant them in pots or flats (shallow boxes) of fibrous loam soil. Good drainage is essential, so put plenty of broken pottery, etc., in the bottom of each container. The seeds can be broadcast or set in rows, the planting depth being about one-half inch. Space the seeds one inch apart to avoid future crowding. Apply water whenever the soil feels dry to the touch and keep the temperature around 60°-70° F. Full sunlight is necessary when the young sprouts start to appear above the soil.

Given favorable growing conditions, the seedlings develop quite rapidly and may require a second transplanting within a month or two. They are not difficult to move and will suffer no set-back if a ball of soil is left on the roots. Use the same soil mixture, etc., but give each seedling at least twice the amount of room it had previously. When the plants have formed two and three sets of

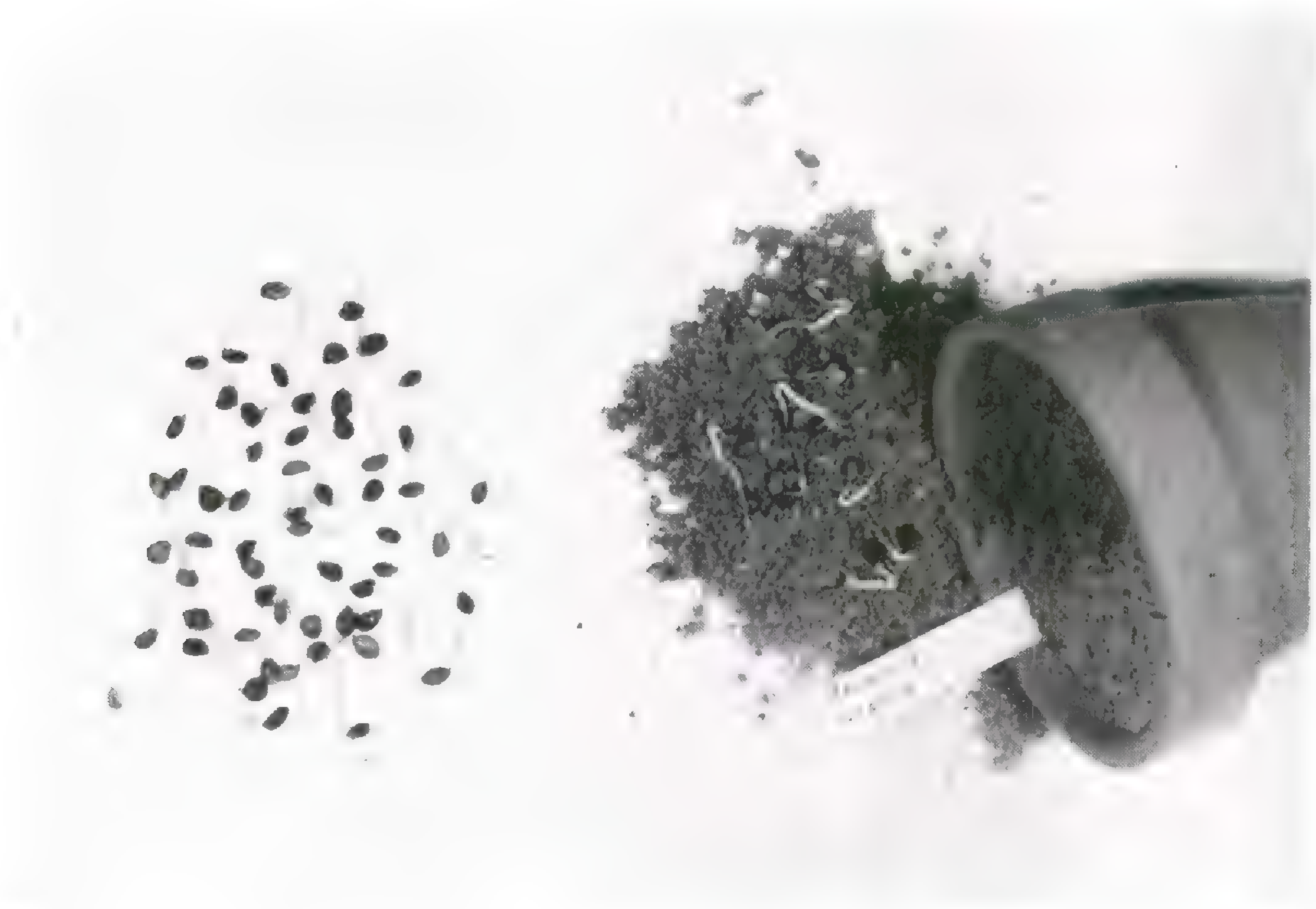


Magnolia seedlings three months after germination of seed. Left to right: *M. glauca*, *M. stellata*, and *M. Soulangeana*.

Seedlings of *Magnolia Soulangeana*, one year old. These plants had been in 4-inch pots and plunged in a cold-frame over winter.



Ripe seed pods of *Magnolia grandiflora*, showing how they split open and shed the seeds.



Sprouted seeds of *Magnolia glauca* stratified in a pot of sand in a cold-frame over winter.

leaves, they are ready to be put into individual pots or transplanted directly into fertile soil in a cold-frame outdoors. A satisfactory practice is to put them in 2½-inch pots and then plunge the pots to the rims in sandy soil in a cold-frame. With slight protection from the burning heat of noon-day sun, the plants will continue to grow rapidly and may need shifting to 4-inch pots before fall.

The first winter it is wise to give the young plants the protection of a cold-frame, mulching them with a few inches of leaves, peat, straw or similar material. Be sure that the soil is well drained and do not keep the lid on the frame closed tightly. A layer of cinders underneath the pots will assure ample drainage. The following spring remove the lid from the frame, take off most of the mulch and apply water as the soil becomes dry. When growth is well started, the plants can be taken out of the pots and put in nursery rows in the garden. Space them about 1½-2 feet apart. Do not disturb the ball of soil on the roots and increase the planting depth one inch. Firm the plants well in the soil and give them a thorough watering. Each row should have a label bearing the name, date, etc., for future reference. Rabbits like to chew on the bark in winter when clover is scarce, but a loose wrapping of heavy paper around the stems will prevent this type of injury; otherwise magnolias are not bothered much with pests.

In about three years from the date of sowing, it is possible to have 2-, 3-, or 4-foot specimens ready to set out in permanent quarters. Raising magnolias from seed is an interesting bit of gardening in which anyone can be successful if these directions are followed.

D. C. F.

THE MUCH-ABUSED ASPIDISTRA DOES FLOWER!

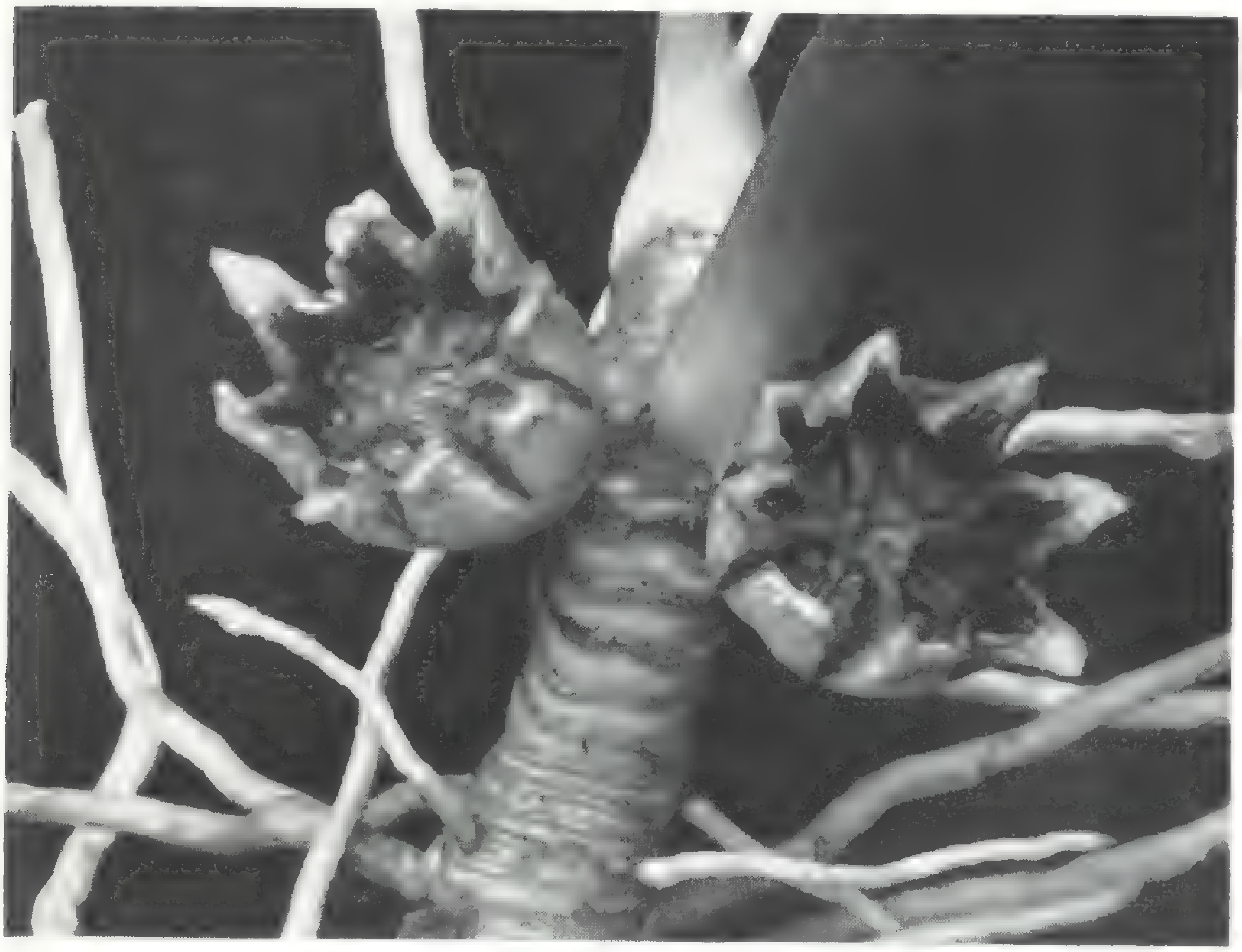
An Aspidistra would not care if it were forgotten and given no water for two or three weeks at a time, though it would like its leaves washed off once in a while. That gives a slight hint as to the ease with which this plant can be grown. Once established in a container, very little care need be lavished upon it. No other house plant, with the possible exception of the Sansevieria, receives so much abuse yet gives so much in return.

Aspidistra is attractive as a house plant chiefly for its dark green foliage. China is its native home, but the plant was introduced into European collections around the year 1822. From the start it was very popular, decorating many homes in the smoky districts of London. It is one of the few house plants which seldom fail, whether kept hot or cold, in east, west, south or north windows. Kitchen gas does it no harm and smoky atmosphere seems not to bother it in the least. It can be grown equally as well in the cramped apartment as in the greenhouse, also in a smoke-filled tavern, hotel lobby, hall-room, basement, or any other poorly lighted place. Because of its universal adaptability and its hardy constitution, the Aspidistra is generally known as the "Cast-iron Plant," and it rightly deserves this appellation. Another common name for it is the "Parlor Plant," and this is also well deserved.

It would be safe to assume that six out of every ten persons possessing an Aspidistra do not know to what plant family it belongs. Surprisingly, it is a Lily, but it is a far cry from the lovely Madonna Lily with its shafts of purest white flowers, or the charming Tiger Lily, whose stems are topped by showy black-spotted orange-colored blossoms. Very few home gardeners even realize that the Aspidistra blooms. Truly, it does not send up lovely spikes as other lilies do. On the contrary, its flower stems are so short that the small individual flowers are often more than half-buried in the soil. Nevertheless, a peculiar type of beauty does exist in the Aspidistra's floral shoots, and this is well illustrated in the accompanying photograph.

Most mature plants of *Aspidistra elatior* bloom regularly each season, but the flowers very aptly mimic the appearance of the soil with their inconspicuous color, and are borne so close to the ground that they frequently go unnoticed. In order to study them at close range it is necessary to scoop out the earth around them, or better still cut off a portion of the flower-bearing rootstock and wash it free of dirt. Then and then only will one get an idea of the wax-like beauty of the flowers.

The blossoms of *Aspidistra elatior* make their first appearance in the form of little, light-colored knobs on the creeping rhizomes. Slowly but surely these push their way through the soil and finally expand into bell-shaped flowers about an inch or slightly more in diameter, borne singly on very short peduncles. The inside of the thick, wax-like perianth is of a lurid purple color, while the outside is creamy-green, with conspicuous purplish dots. The perianth lobes are eight in number—a very unusual feature in the Lily Family—and for this reason the genus Aspidistra is considered abnormal. Besides this, there are several other unusual characters. The style is thick and expands into a large discoid eight-rayed stigma, which completely closes up the top of the short tube. The eight pollen-carrying stamens are located within the short flower-tube, hidden from sight by the disk-like stigma.



FLOWERS OF ASPIDISTRA

Pollination can only be carried out by tiny insects which pass through the small narrow slits on the stigmatic surface. Self-pollination will not insure fertile seed, and for this reason fruits are uncommon in cultivated plants. However, this is no disadvantage, for the plants multiply rapidly from the creeping rootstocks. As a rule, keep the Aspidistra fairly well watered and sponge the leaves now and then. There is scarcely a limit to its endurance. In conservatories, it is highly decorative as a border plant or when placed around large pots and tubs. L. C.

HENRY SHAW, PHILANTHROPIST AND PROPHET

It was the morning of May 4, 1819, when the steamer "Maid of Orleans" arrived at the small French trading post called St. Louis, a village of less than 4,000 inhabitants. The boat had been three weeks on the way from New Orleans and might have taken longer had not the rail fence of Judge Bent, who lived on the river below the town, furnished the necessary fuel to reach port. There were fourteen passengers aboard, each of whom had paid $120.00 for the trip. But of the group it is a boy 19 years old in whom we are interested. With his father he had come from Sheffield, England, to Canada the year previous and later he had been sent to New Orleans with the idea of learning the cotton business. For some reason, however, the prospect did not suit the youngster and he decided to try his fortune further north. Little could any of the idle throng that watched the "Maid of Orleans" dock that bright May morning realize what it meant to the future city of St. Louis that the boy had not stayed in New Orleans.

That he was prepared to stay in St. Louis was evidenced by the small stock of cutlery he had brought with him from Sheffield, and he lost no time trying to find a location in which to display his goods. With some difficulty the budding merchant found a room on the second floor of Number 4, Main Street, where he not only had his first store but for several years lodged as well.

It was not long before the sign, *Henry Shaw Hardware,* became a familiar one, not only to the people of St. Louis, but to Indian traders and agents in the West, as well as to eastern American and English firms. In time the business included textiles and other necessities for a growing region. Much trade in buffalo hides and tongues (the latter considered a great delicacy), and even beeswax, developed, and *Henry Shaw Hardware* became *Henry Shaw Merchant.* In fact, by 1840 Mr. Shaw had become not only one of the leading business men of his adopted city but was known throughout this country and abroad as one of the most prominent and prosperous shopkeepers in the West. Indeed, so rapidly had the business grown that it took only twenty years to build it from that small combination lodging and store to one showing an annual profit of $25,000. "More money than any man in my circumstances ought to make in a single year," said Mr. Shaw, so at the age of 40 he sold out and retired, free to travel and indulge any hobby he might have cherished.

Between 1840 and 1851 Henry Shaw made three trips abroad and saw not only the usual European cities visited by tourists, but Constantinople and Egypt as well. Undoubtedly, he visited many gardens, and his natural love for plants must have been greatly stimulated by the variety and beauty of the vegetation of the various regions through which he passed. But it was not until his last trip to England, in 1851, that the idea of having a botanical garden of his own seems to have crystallized. It is supposed to have been while walking through the grounds of the Duke of Devonshire, at Chatsworth—regarded as the most magnificent private estate in Europe—that Mr. Shaw said to himself, "Why may I not have a garden, too?"

However, this was not the first evidence of Henry Shaw's love for trees and flowers. As a child, he, with his two sisters, spent many happy hours working in the little garden of their home. Later, when he attended Mill Hill School, not far from London, he came under the influence of the famous trees planted by Linnaeus, Collinson, and others. Indeed, in the history of this school the statement is made that "he [Henry Shaw] used to trace his interest in botany to the sight of the Linnean cedars at Mill Hill." Thus as a boy, quite unconsciously, he fell under the spell of the beauties of nature, and later in life this early influence manifested itself in the creation of a botanical garden which was to rank with any similar institution in the world.

It was on March 14, 1859, that a special act of the General Assembly of the State of Missouri was approved, enabling Henry Shaw to convey to Trustees certain lands to "maintain and establish a botanic garden for the cultivation and propagation of plants, flowers, fruits and forest trees."

Philanthropists usually have a hard time hitting upon a permanent means of perpetuating either their names or their benefactions. Looking back over a period of years one cannot but be sorry for those people who, having come into a fortune and wishing to benefit the community in which they lived, have failed so completely in devising satisfactory means of carrying out their intentions. Either the gift is misapplied or the conditions change until it becomes a symbol of unintelligent effort entirely missing the intention of the donor.

Not so with Henry Shaw. His gift of Tower Grove Park, with some of the most artistic and worth-while statues of famous men to be found anywhere in the country, is alone an outstanding example of a successful public benefaction. When we come to consider the Missouri Botanical Garden, the care and foresight with which Mr. Shaw planned this gift is difficult to realize unless one is familiar with the details. For these we must turn to his last will and testament, admitted to probate on September 2, 1889, which provides for the establishment of the Missouri Botanical Garden. Here we find, after the usual family and personal bequests and the provision for the transfer of the bulk of his estate to a Board of Trustees named in the will, those minute instructions for the conduct and scope of the Garden which make it such a famous and useful institution. No ordinary donor would have the vision and imagination manifested by Mr. Shaw in outlining the way in which his bequest was to be used. It is true that he sought the counsel and advice of Dr. George Engelmann, his fellow townsman and close friend, an internationally known botanist. Professor Asa Gray, of Harvard, and Sir Joseph Hooker, of Kew, were likewise consulted. This alone is an indication of the care with which Mr. Shaw made his plans. But to him is due the sole credit of founding a scientific institution rather than a mere show place; for providing that a School of Botany be established, in connection with Washington University, "for the promotion of education and investigation in that science"; for declaring that at the Missouri Botanical Garden "scientific investigations in Botany proper, in vegetable physiology, the diseases of plants, the study of the forms of vegetable life, and of animal life injurious to vegetation, experimental investigations in horticulture, arboriculture, etc., are to be promoted." And here is one of the most significant clauses in the entire will, so frequently neglected by those making bequests. Mr. Shaw wrote: "But I leave details of instruction to those who may have to administer the establishment, and to shape the particular course of things to the condition of the times."

Long before his death Mr. Shaw began to lay the foundation for the scientific background of his Garden. Early in the fifties and sixties he directed the purchase of books and dried specimens of plants from all over the world; so that now the library and herbarium of the Missouri Botanical Garden, those most necessary tools for the prosecution of botanical work, take first rank with similar collections. Considering "it an important feature to keep up the ornamental and floricultural character of the Garden," he nevertheless realized that no botanical garden could long hold a place in the scientific world unless provision was made for research and investigation in the field of botany.

Mention should also be made of some of the unusual bequests included in Henry Shaw's will, bequests which illustrate with what thoroughness the founder of the Garden arranged for the carrying out of his wishes. Few benefactors would have provided for a banquet "to the Trustees and to literary and scientific men and friends and patrons of the natural sciences," or for an annual banquet "to the gardeners of the institution and invited florists, nurserymen and market gardeners," or for prizes for flower shows or exhibitions. Perhaps the most unusual provision in this or any other will is that which enables the Episcopal Bishop of Missouri to have an annual sermon preached "on the wisdom and goodness of God as shown in the growth of flowers, fruits and other products of the vegetable kingdom." So far as is known, nowhere else in the world is such a sermon delivered because of a specific provision in a man's will. Certainly no botanical garden has any such ceremony regularly provided for.

One other point about this remarkable will. At no place, in any way was the name of Shaw to be connected with the Garden. While known locally, in affection for the founder, as "Shaw's Garden," Mr. Shaw himself specifically designated that it should be called the Missouri Botanical Garden and had this name cut in stone over the main entrance. This is its official title, and by every means in his power Mr. Shaw indicated that he did not expect or want his name to be used, thus exhibiting a broadmindedness and modesty that is quite as rare as some of the provisions of his will.

NOTES

Dr. Edgar Anderson, Geneticist to the Garden, has been appointed to the editorial boards of *American Journal of Botany* and of *Madroño.*

Mr. Paul A. Kohl, Floriculturist to the Garden, has an article in the February number of *Nature Magazine* (**34:** 81-82), "Gas Plant or Burning Bush."

Dr. George T. Moore, Director of the Garden, spoke over Radio Station KFUO, January 8, on "Services of the Garden to the Community," and January 15, on "Services of the Garden to the Botanical and Horticultural World."

Mr. Ladislaus Cutak, in Charge of Succulents at the Garden, has been elected a Fellow of the Cactus and Succulent Society of America, in recognition of his lectures and writings on succulent plants and for his cooperation with the Society.

Mr. Paul A. Kohl, Floriculturist to the Garden, gave a talk on seed catalogues before the Garden Club of St. Louis, February 4. On February 5, he showed the colored moving-pictures, "The Four Seasons in the Garden," at the Emmau Lutheran School Hall.

Mr. William L. Brown, Graduate Student at the Garden, and Dr. Edgar Anderson, Geneticist to the Garden, are the authors of a paper appearing in the December number of *Castanea* (**5:** 124-125), entitled *"Poa cuspidata* of the Appalachian Plateau and Atlantic Coastal Plain."

Dr. Carroll W. Dodge, Mycologist to the Garden, has been granted a leave of absence from February 1941 to June 1942, to accept an exchange professorship in Guatemala. Dr. Grant D. Darker, recently of the Farlow Library and Herbarium of Harvard University, will take Dr. Dodge's place until he returns.

Mr. George H. Pring, Superintendent of the Garden, has given the following talks recently: "A Trip Over the Andes of South America," before the Men's Club of Tyler Place Presbyterian Church, January 16; "Experiences in Plant Collecting," before the Fellowship Group of the Central Presbyterian Church, at

Clayton, January 19; "What to Plant in the Garden," before the Catholic Woman's League, February 4.

Mr. Ladislaus Cutak, in Charge of Succulents at the Garden, has an article "Cacti in the Outdoor Garden" in the February number of *Real Gardening* (3^2: 28-31). In the January number, *Real Gardening* (3^1: 62-72) has reprinted his "Haworthia" article from the May 1939 Garden BULLETIN, the title having been changed to "Succulents Supreme."

An abstract of the doctor's thesis of Dr. Henry N. Andrews, Instructor in the Shaw School of Botany, is contained in the December 30 number of *Chronica Botanica* (**6**: 150-151). The paper is entitled "On the Stelar Anatomy of the Pteridosperms with Particular Reference to the Secondary Wood" and appeared originally in the February 1940 number of the ANNALS OF THE MISSOURI BOTANICAL GARDEN.

Recent visitors to the Garden include: Dr. Lincoln Constance, Assistant Professor of Botany, University of California, Berkeley; Dr. Harry J. Fuller, Assistant Professor of Botany, University of Illinois, Urbana; Mr. Eugene S. Heath, Director, Georgia Botanic Garden, Atlanta; Mr. Hugh A. Stevenson, Associate Horticulturist, and Mr. C. J. Coukos, Assistant Agronomist, Soil Conservation Service, U. S. Department of Agriculture, Elsberry, Mo.; Dr. Carl Swanson, Fellow, Department of Plant Breeding, University of Missouri, Columbia; Dr. Reginald R. Gates, formerly of the University of London, England; Miss Helen Neuman, graduate student, University of Cincinnati.

STATISTICAL INFORMATION FOR JANUARY, 1941

GARDEN ATTENDANCE:	
Total number of visitors	13,712
PLANT ACCESSIONS:	
Total number of plants and seed packets received as gifts	17
LIBRARY ACCESSIONS:	
Total number of books and pamphlets bought	10
Total number of books and pamphlets donated	26

Herbarium Accessions:

By Purchase—	
Krukoff, B. A.—Plants of Bolivia, South America	1,354
Thompson, J. William—Plants of Washington	734
Williams, Louis O.—Orchids of Mexico	100
By Gift—	
Daily, William A.—*Ephebe lanata* (L.) Wainio from Kentucky	1
Hubricht, Leslie—Lichens of Missouri	5
Von Schrenk, Hermann—*Asparagus* sp. from horticulture	2
Williams, Louis O.—Type specimens of orchids	42
By Exchange	
Breitung, A. J.—Plants of Saskatchewan	228
Field Museum of Natural History—Apocynaceae and Asclepiadaceae of Guatemala	35
State University of Iowa—Fungi of Maine, Virginia, Iowa, Panama, and Colombia	24
U. S. Department of Agriculture, Division of Plant Exploration and Introduction—Plants of Nevada	249
Utah State Agricultural College—Plants of Utah	73
Total	2,847

STAFF
OF THE MISSOURI BOTANICAL GARDEN

THE GARDEN, 2315 TOWER GROVE AVENUE, ST. LOUIS, MISSOURI

George T. Moore,
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Hermann von Schrenk,
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Jesse M. Greenman,
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Carroll W. Dodge,
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"A book that is complete. . . . Undoubtedly the book Missouri flower-lovers have been looking for."
Missouri Historical Review

". . . In short, the *Spring Flora of Missouri* is the best 'Spring Flora' available at present in the United States."
American Midland Naturalist

"Should be of great use to local garden clubs, and for the scientific worker who is concerned with the local flora it should be invaluable."
National Horticultural Magazine

"Carefully and critically done, so that it should find wide and enthusiastic reception at the hands of all who enjoy being acquainted with the rich native flora of Missouri."
Rhodora

"The most comprehensive spring flora ever issued for any state. . . . Notable for presenting its data in simple non-technical English, yet with thorough scientific accuracy. Book's value not limited to Missouri."
Field Museum Notes

For sale by the Missouri Botanical Garden. Price $3.00

MISSOURI BOTANICAL GARDEN BULLETIN

Vol. XXIX MARCH, 1941 No. 3

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TWENTY-FIVE CENTS

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Missouri Botanical Garden Bulletin

Vol. XXIX MARCH, 1941 No. 3

TROPICAL WATER-LILIES

During the past twenty-five years there have been described in the BULLETINS of the Missouri Botanical Garden some eighteen new varieties of tropical water-lilies. In the February 1934 BULLETIN detailed descriptions of all the named varieties and six varieties carried under number were given and illustrated by means of colored plates. It now seems desirable to give names to those varieties formerly designated by number, since in most cases they have demonstrated their worth. Because of the increasing interest in tropical lilies and the numerous questions received concerning their growth and care, there has likewise been brought together information calculated to assist the amateur and make it possible for anyone with the necessary facilities to include in his garden one or more of these plants.

Pools.—Since success or failure with lilies depends somewhat upon their location, a few general facts about the pools in which they are to be grown are necessary. Full sun is essential for all water-lily culture.

The depth of the pool will depend upon whether you are raising your lilies in boxes or in a natural soil bed. The lilies need about one foot of water above them for proper development, and at least a foot of soil in which to grow. If you plant them in boxes, allow a bushel of soil to each plant; if you plant them directly in pools spread a foot of soil over the concrete, or if you happen to own a real pond you need worry only about the water level itself. Lilies need a spread of six feet to grow properly.

It is not necessary to provide a continuous supply of fresh water for a lily pool. In fact, the lilies do best in water of a warm and even temperature, and if the pool is stocked with fish, snails, etc. the water will keep pure and clear. Only enough fresh water need be added from time to time to replace that lost by evaporation. The fish supply in your pool is important in order to keep down the mosquito larvae.

Soil.—Due to the fact that the pool is discolored by a completely soil-covered bottom, plus the problem of weed control, many prefer to raise their lilies in boxes or half barrels, setting these containers on the pool floor. The lilies grow better if their root spread is free, but the box or barrel container, if it holds a full bushel of soil, is quite satisfactory and, for the average amateur, much simpler.

Water-lilies are heavy feeders, and demand a generous supply of fertilizer. Cow manure is very much to their liking. For a natural-bottom pool, spread it to a depth of two inches, and spade it under; or, if containers are used, put a two-inch layer of manure in the bottom of the box or barrel, and fill up with sod soil. However, since in many localities it is so difficult to get manure, particularly the properly aged kind, many growers turn to the more easily obtainable inorganic fertilizers.

For several years, we used with success a formula similar to that used on trees, namely 10 per cent nitrogen, 8 per cent phosphorus, and 6 per cent potash. For the past two years, however, we have changed to an even stronger formula, known in the trade as "Nitrophoska," with a ratio of 15 per cent nitrogen, 30 per cent phosphorus, and 15 per cent potash. Naturally, this stronger fertilizer must be used with extreme care. A maximum of 1 pound to 100 square feet is broadcast over the surface of the soil and spaded under. It is safer to mix it with sand, to insure a more even distribution, and the large crystals must be crushed to prevent too heavy a concentration in one spot. For each container, a tight handful (2 ounces) is ample, and it should be thoroughly crushed and then carefully mixed with the bushel of soil to avoid any extra doses being contacted by the searching roots. This soil must be discarded at the end of the growing season, and fresh soil used the following year.

Pests.—Before the water-lilies attain sufficient growth to shade the pool, algae can be a most unsightly pest. If the pool is large and has no fish, algae may be controlled by the use of copper sulphate. Early in the spring, fill a little cheese-cloth bag with the copper sulphate, suspend it from the end of a stick, and drag it slowly through the pool until the water turns blue. After a day or two, set out the lilies, but fish should not be put in the treated water for at least a week.

For a small pool, or one which is already stocked with fish, permanganate of potash is a safer means of control. Put two or three teaspoonsful of this chemical in a jar containing a gallon of water, and stir. Let it stand until the water has absorbed all the permanganate it can take up and there is still a slight residue in the bottom of the container. You now have a saturated solution, and approximately one teaspoonful of it to a gallon of water will effectively control algae. You may use it not only before the lilies are planted, but at any time during the growing season. Only the youngest of baby fish will suffer, and the older fish don't seem to mind it at all. The copper sulphate gives a more lasting effect, but is really too toxic for safe use by the amateur gardener, and cannot be applied full strength during the growing season without fatal results to fish.

Another pest which causes trouble in natural ponds is the crawfish. They may cause leaks in the banks, or they may pinch off the young leaves before they reach the surface. When warm weather appears, 1 pound of tobacco dust to each 100 cubic feet of water may be broadcast as an effective control. This pretreatment will save you much difficulty later on, but if you have neglected it and are bothered by crawfish a poisonous bait may be used. Paris Green on chopped meat placed at the edge of the pool is effective.

Natural-bottom ponds are subject to trouble from aquatic weeds, such as Aponogeton Sagittaria, Typha, Callitriche, etc. To keep them in check, scarify the bottom of the pools once a week.

There are relatively few insects which attack water-lilies, and for their control hand-picking or forceful water spraying should be resorted to rather than insecticides which may also kill the fish. Large pests, such as the delta moth larva, *Hydrocampa proprialis,* may be picked by hand. Aphis, particularly the black variety, will always make themselves at home on the floating leaves. A forceful water spray will not only remove them but will furnish live food for the fish. If no fish are present, nicotine sulphate may be used.

The leaf miner *(Chironomus modestus)* sometimes tunnels its way under the epidermis of the leaves, causing yellow, irregular lines. Where growth of plants is rapid, the leaves may be cut off at once and burned. If there are no fish, dust dry powdered arsenate of lead over the leaf surface with a powder bellows.

The delta moth larva, mentioned previously, is an insect which is very active in St. Louis from July on. However, growth is so rapid in the lilies at this time, demanding weekly removal of leaves, that this pest is of more interest than it is a menace. Eggs are laid on the under-side of the young leaf edge. The insect cuts two triangular pieces from the leaf edges, varying from ½ to 1 inch, and fastens itself between them by a web. Completely hidden, it travels in its triangular boat or raft over the water surface to other plants. Hand-picking should be sufficient for its control, but if no fish are present powdered lead arsenate is effective.

Recently, in St. Louis, the young tropical water-lilies, particularly the night bloomers with colored leaves, have been eaten by the larvae of the family Chironomidae, two or three days after planting. These pests are very hard to locate. It is not until the ruined leaves are cut off and allowed to dry that the larvae may be observed as colorless, thread-like worms about ¼ inch long. Should these pests become serious, the only thing to do is to remove the fish from the pool and sprinkle tobacco dust at the rate of one pound to each 100 cubic feet of water.

So far St. Louis has not been bothered with the leaf beetle, *Galerucella nymphaeae*, but since some parts of the country find it troublesome, it is described. The beetle measures ¼ inch in length, and when matured lays its eggs on the surface of the leaves in clusters of 6 to 20, bright yellow in color, ovate in outline. The larvae are bluish-black above, and yellow on the underside, elongate in form, about ⅜ of an inch in length, widest in the center, tapering toward each extremity. They feed both upon flowers and the upper leaf-surfaces, and are particularly damaging to the upturned edges of the Victorias. Remove the fish before using the control, which consists of 1 part Paris Green to 50 parts of air-slaked lime, applied by powder bellows.

Botis nelumbialis attacks the lotus (Nelumbium) and is readily observed when it rolls and gums itself between the edges of the small leaves. It is a voracious feeder, soon destroying the concave leaves, but it may be controlled by hand-picking and burning. The alternative control, by arsenical poison spray, is, of course, fatal to fish.

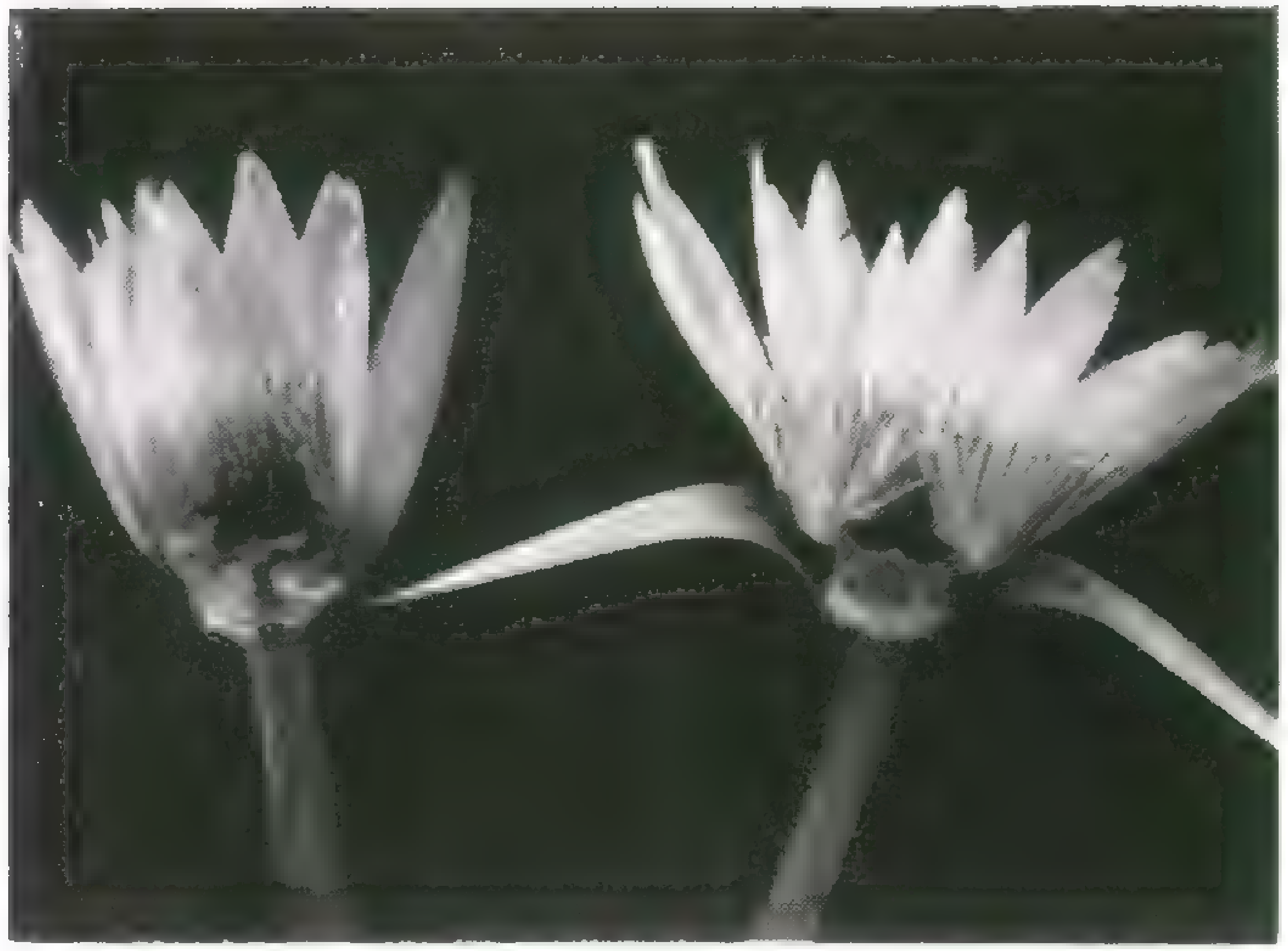
About the only fungus known to bother lilies to any extent is a *Cercospora,* which discolors the leaves in irregular or circular spots and frequently causes the edges to dry and turn up. Since the fungus spreads rapidly these discolored leaves should be immediately removed and burned to prevent spore distribution. Where necessary, and if no fish are present, the plants may be sprayed with Bordeaux mixture, using half the usually recommended strength.

Planting Out.—If the pool is large, a plan drawn to scale will save considerable time in planting out and insure better color harmony. The actual place for the lily should be indicated by a bamboo stake, to be removed after the young plant is established. Then, if it should go to sleep unexpectedly, the stake will indicate the location of the dormant tuber.

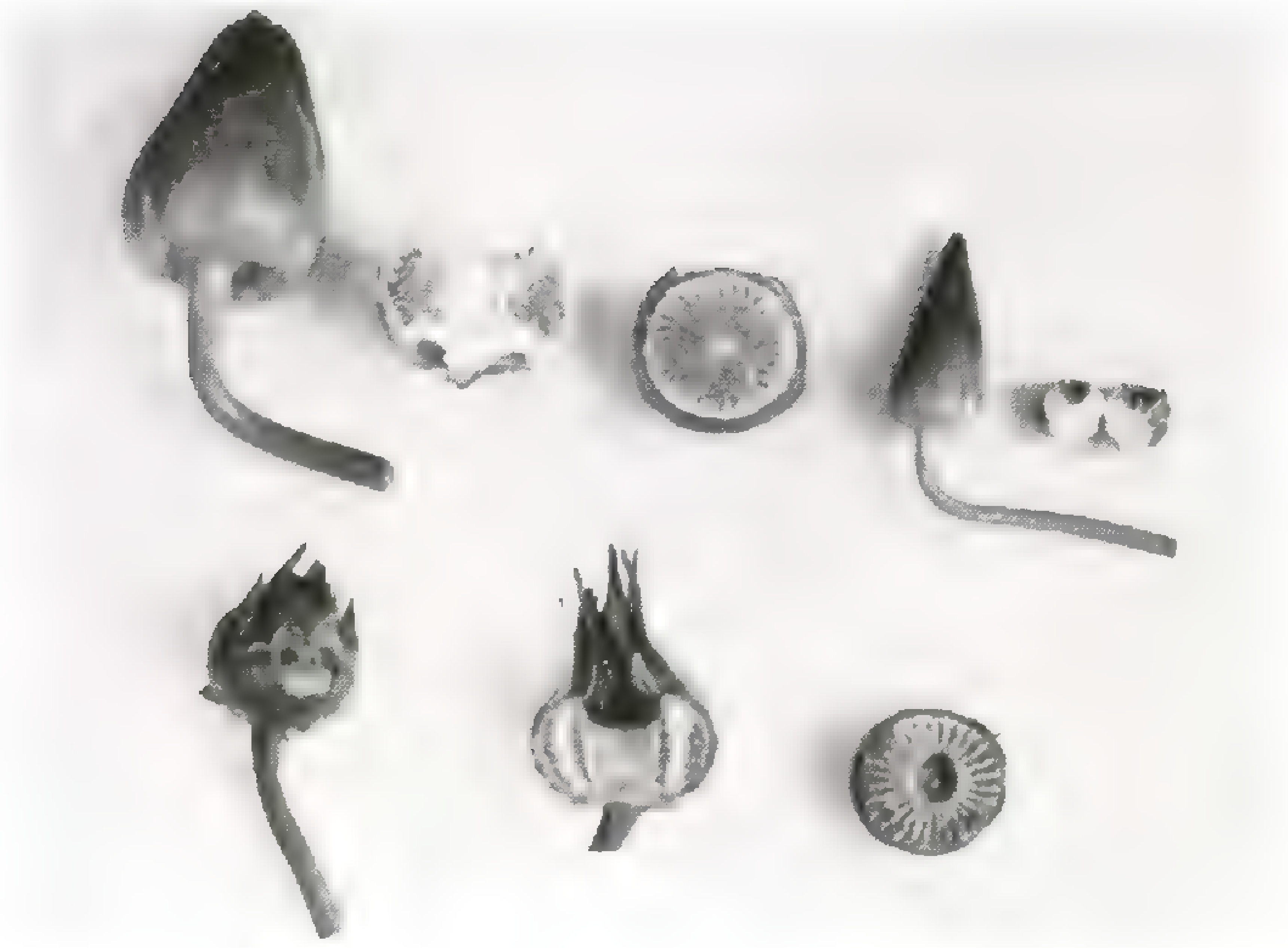
One water-lily to each receptacle or container is the rule. Two lilies planted together will become unbalanced and spoil their natural radial growth. Allow at least six feet of space for each plant, otherwise the new leaves will be crowded out of the water, flowers will be disfigured, and you will have lost the perfect pattern normally created by leaves, water, flowers and sky reflection.

Unpack shipped plants immediately on receipt and place them in water until they can be permanently planted. When transferring the young plants from the greenhouse or shipping containers to the outside pools, be careful to protect them from the sun and prevent any drying out of leaves or roots by wrapping with wet burlap.

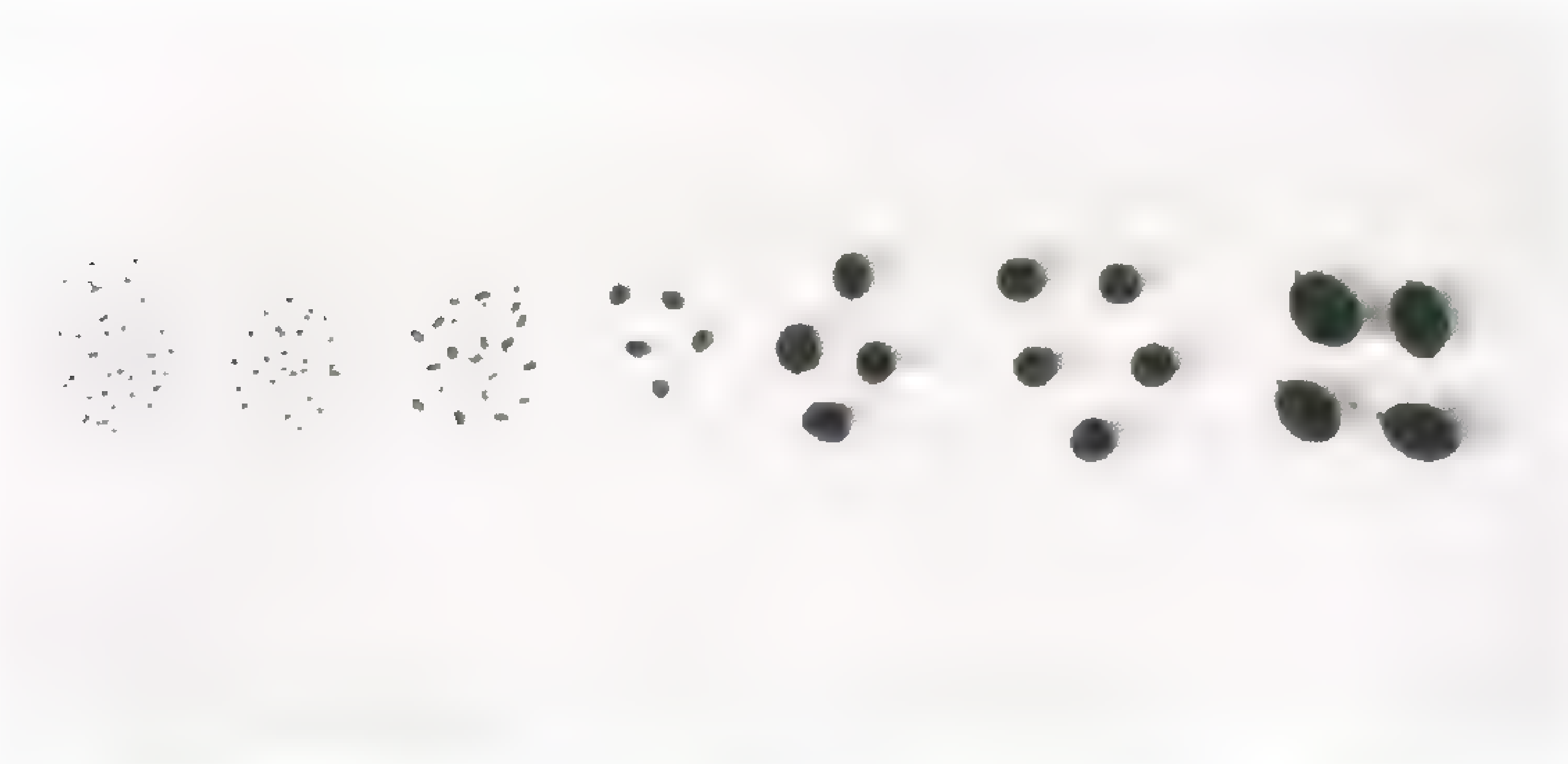
Keep the plants in their pots until just ready to plant, or else most of the moist soil will fall away from the roots by the time you wade through the water to the marker stakes. To plant properly, scoop out a hole equal to the size of the pot. Remove the plant by inverting the pot, holding it with the left hand and tapping the base with the right palm. Plant the unbroken ball in the



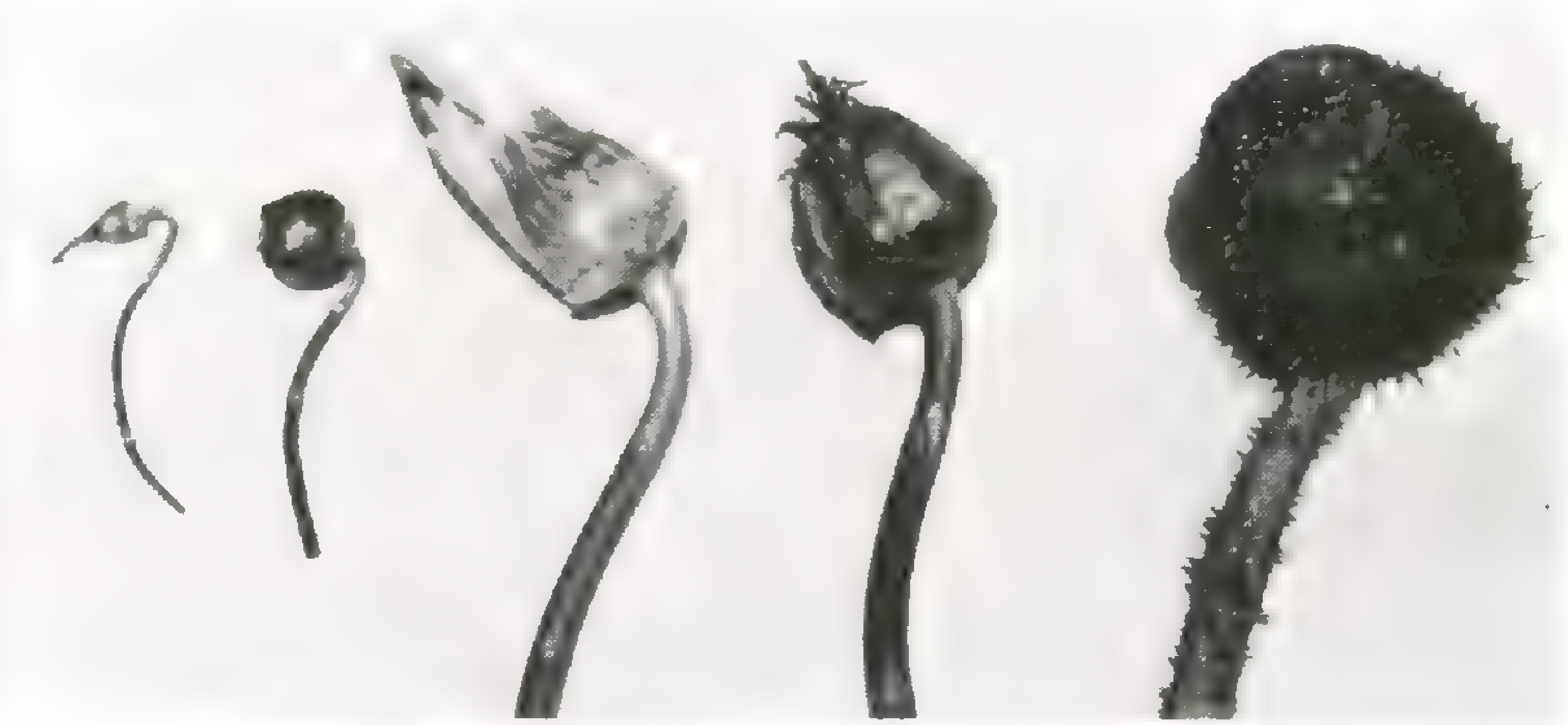
Showing vertical stamens on first day (left) and inflexed stamens after first day (right).



Top, seed-pods of tropical day bloomers, fertile (left), sterile (right); bottom, fertile seed-pods of night-bloomers



Types of water-lily seeds. Left to right: tropical day-bloomer, night-bloomer, *Nymphaea gigantea* (Australian), hardy, *Euryale ferox*, *Victoria regia*, and Nelumbium.



Showing variability of seed-pods. Left to right: *Nymphaea tetragona*, hardy, tropical day-bloomer, tropical night-bloomer, and *Victoria Cruziana*.

PLATE 10

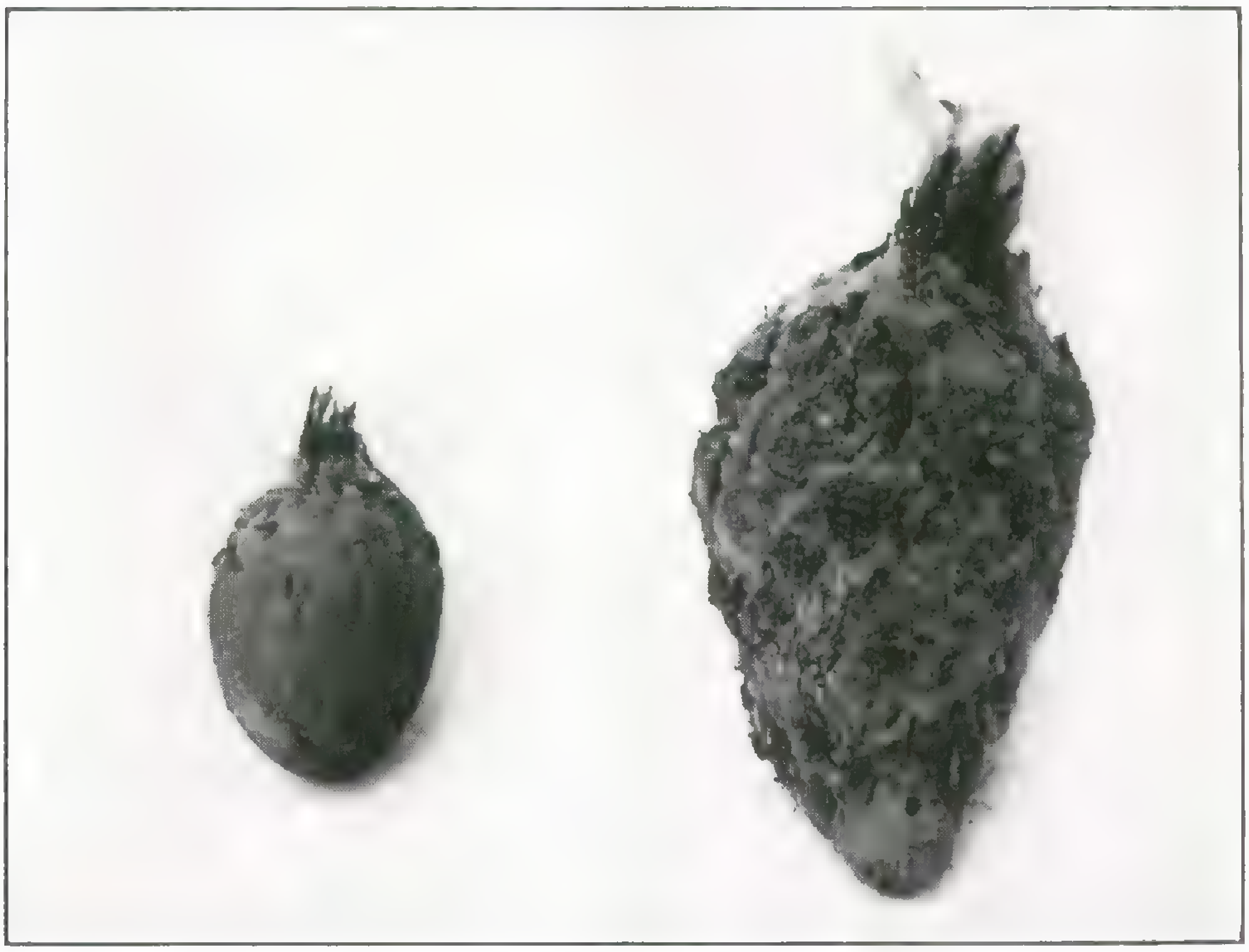
hole and firm down, with the crown of the plant slightly above the ground level. Cover the soil surface with sand or gravel to prevent disturbance by fish, being sure that the crown of the plant is left uncovered.

Sometimes, immediately after planting, the leaves remain submerged, but don't be alarmed. They will extend their petioles and reach the surface the next day. However, one foot of water above the plant should be the maximum at planting time. If the pool is so deep that a higher level is necessary to fill it, water may gradually be added as the plants develop, but 18 inches is the greatest water depth permissible above the crown of the lily.

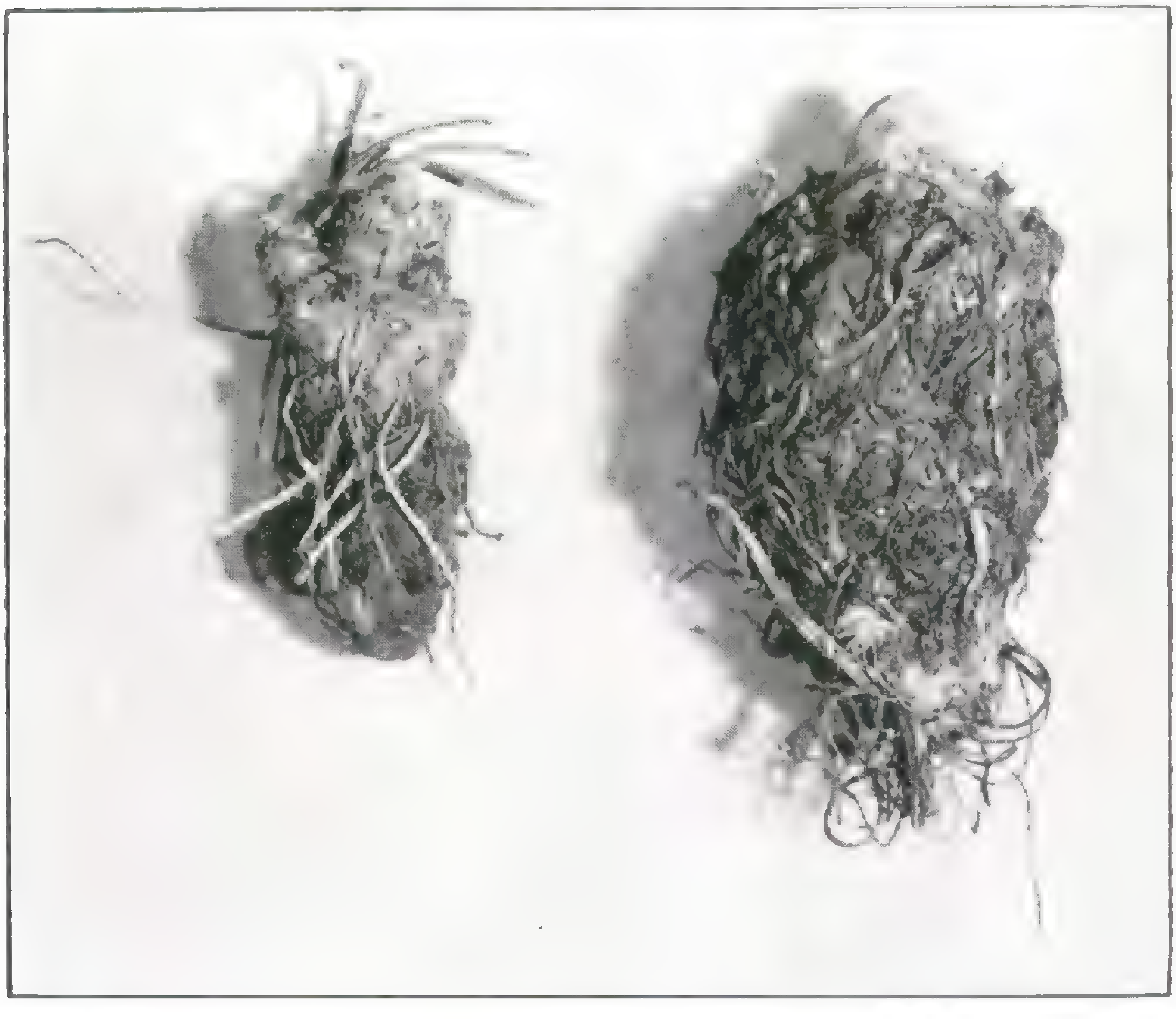
The time to plant lilies outside will depend entirely on where they are to grow. Tropical water-lilies cannot stand a water temperature below 70° F., and nothing is gained by setting them outside too soon. A lower temperature renders the plants dormant, and they are slow to recover. In the Middle West, tropical water-lilies can usually be planted by the middle of May, but in the East and the Great Lakes regions, the first of June is more likely to provide the necessary 70° minimum, both day and night.

Summer Maintenance.—During the summer, a simple program of maintenance should be followed. In addition to eliminating the few pests which may attack your lilies, remove all discolored leaves and faded flowers, as well as seed-pods. If you are growing any viviparous lilies which you want to propagate, don't cut the old leaves until the tiny plants in the leaf sinuses have developed. Some "vivips" are strong enough to start young plants within the second whorl of leaves, but many of them are slow to form and appear only in the outer leaf circle. Remove all floating leaves and debris from the pond to prevent it from becoming unsightly. A handy gadget may be made from a copper screen wire, stretched across a frame about 1′ × 18″, attached to a six-foot handle. With this you can readily skim the pool's surface and keep it clear to reflect the sky and outline the leaf pattern of the lilies.

Propagation.—Since the propagation of tropical water-lilies demands full sunlight and heated water over the winter, most amateurs prefer to buy fresh plants each spring. However, it is possible to raise tropical lilies in an aquarium if the necessary constant heat is provided by electrical coils or some similar device.



Left, small propagating tuber kept dormant in sand for three years; right, parent tuber, showing young tuber forming at base.



Left, parent tuber of day-bloomer, showing formation of new tuber at base; right, parent tuber of night-bloomer, showing many young tubers at top and base.

Those having the necessary equipment may wish to experiment, so directions are herewith included.

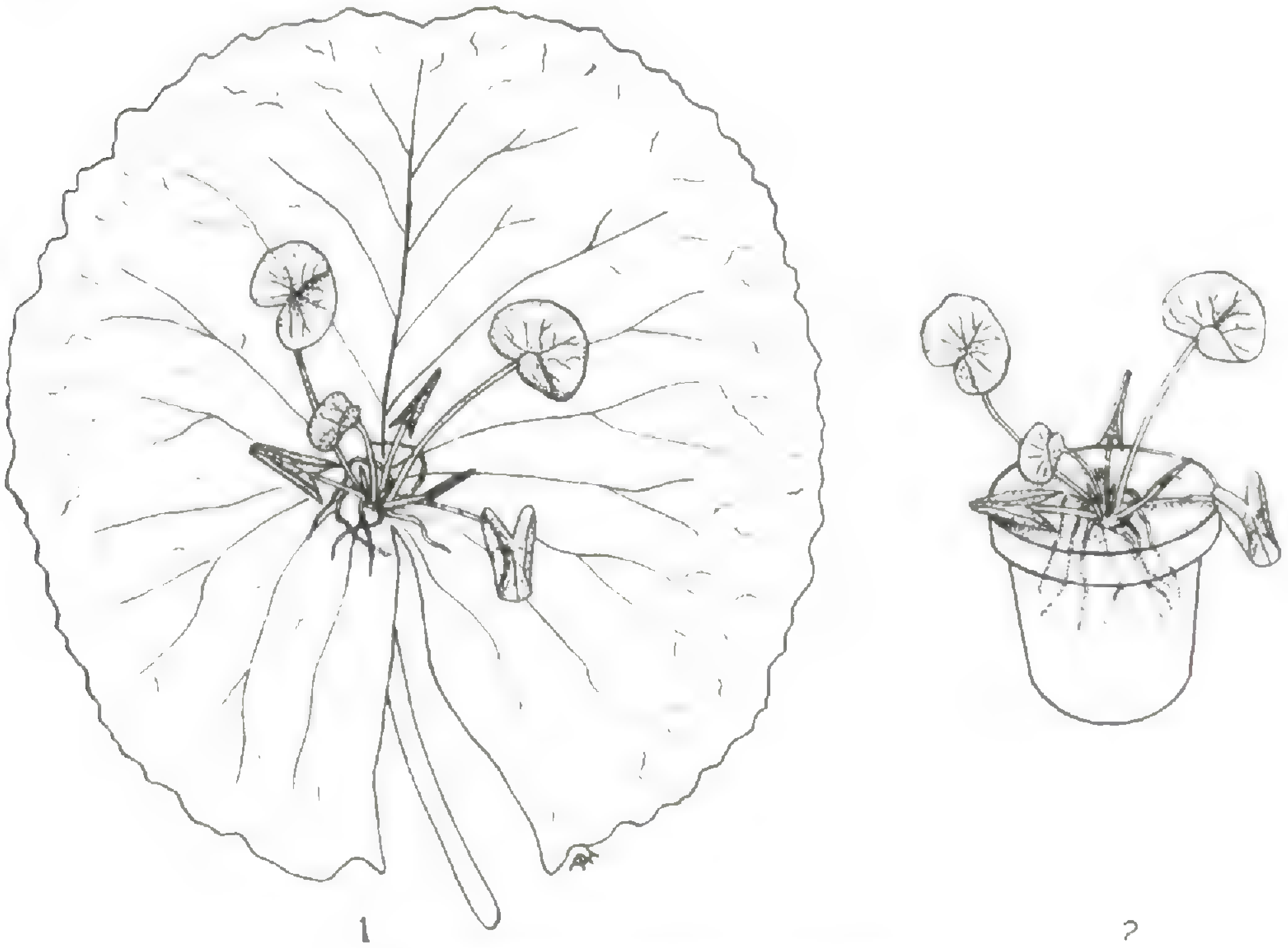
Tropical water-lilies may be propagated from tubers, from seed, or from viviparous plants. Seed of hybrid lilies do not usually come true to type and may produce a flower not worth keeping. It is definitely not recommended for the amateur. Propagation by tubers is the method most likely to be successful, unless viviparous plants are available.

After the first frost, dig up the water-lily plant and wash off the soil. The large evident tuber has produced the current growth and is almost impossible to store satisfactorily over winter. However, at the base of most large tubers will be found a tiny propagating tuber, about the size of a walnut. Night-bloomers and hybrids of *N. colorata* origin bear baby tubers at the top of the old bulb as well as at the bottom. Remove these small tubers, store them in slightly moist sand, in closed containers, until early spring. When the sunshine begins to have sufficient strength to make their growth possible, pot them deeply (about 2 inches deep) in sandy soil. This deep planting is important, since it induces a long growth away from the tuber itself. Place the pots in water of 70° F. or more, in a sunny window. The young leaves should appear in about two weeks. As soon as the floating leaves are developed, use your thumb and forefinger to locate the stem-like growth connecting the young plant to the tuber. Follow this stoloniferous growth down to the tuber, and carefully pinch it off just above the tuber, removing the young plant with its attached roots, but leaving the propagating tuber in the pot.

Immediately pot up the young plant, to prevent its drying out, and place it in the same heated tank in which the propagating stock is growing. In two weeks the original propagating tuber will send up another plant, which can also be removed and potted in the same fashion as the first. This process may be repeated three or four times before the tuber is allowed to retain the last plant. The tank will then be filled with infant water-lilies capable of producing flowers of the same quality and variety as the original plant.

The viviparous group of tropical water-lilies (those in which the young plants sprout while still attached to the parent) now includes a great many fine types. As they form in the leaf sinuses during the growing season, remove them from the leaves after their own roots have developed and pot them up. The pots may be stood up on bricks in a corner of the lily pond until cool weather sends them indoors to the heated tanks, where they will not only grow but will probably bloom a bit the first winter.

It is well to remember that the usual multiple-headed plants raised from viviparous leaves will have smaller flowers than the single-headed forms raised from tubers. Not much can be done to reduce a multiple-headed plant once it has been set out in the pools, but in the propagating stage practically all viviparous lilies can be divided readily into single plants while they are still in the formative growth period. Remove the young lily from the pot when the individual growths, with a central shoot to each one, are readily discernible. Use a sharp knife to cut through the thickened tissue where the new tuber is forming, thus obtaining several tiny plants, with attached roots. These can then be



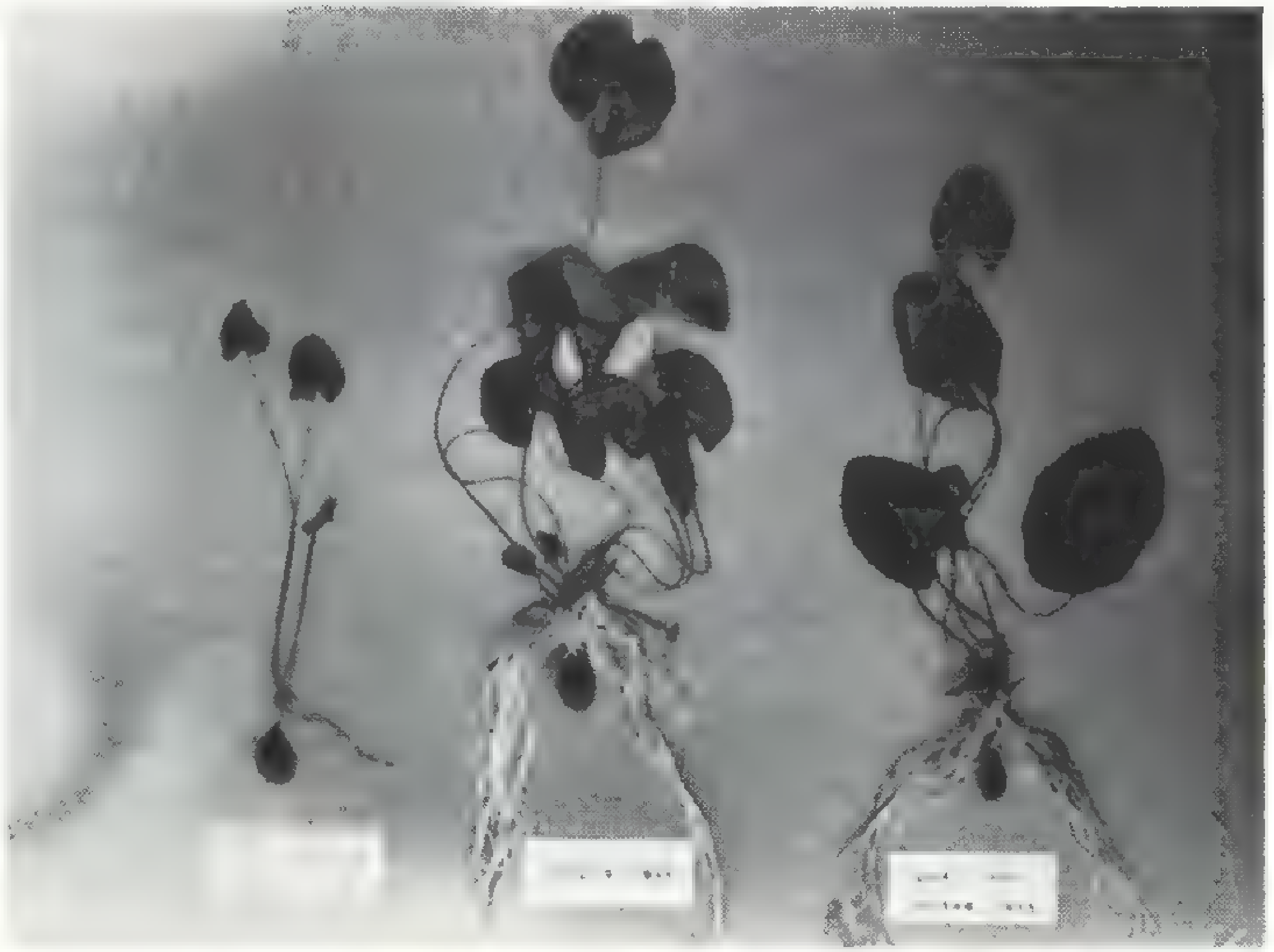
VIVIPAROUS PROPAGATION

1. Showing production of young plants from center of leaf. 2. Young plants removed and potted.

Storing young tubers in the fall.

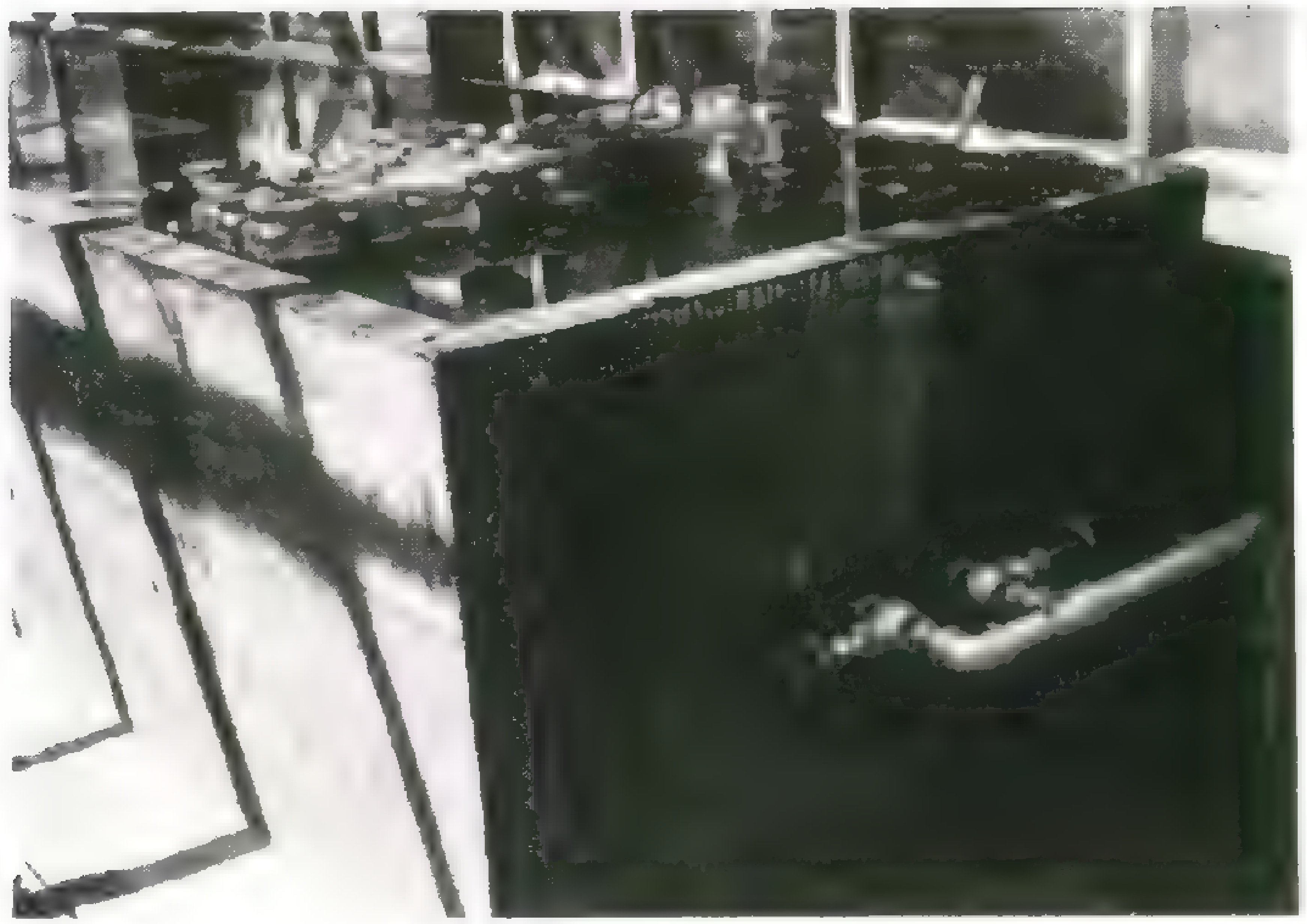
Potting tubers for propagation.

Removing young growth in the spring, leaving tuber for subsequent growth.



Showing young growth attached to propagating tubers.

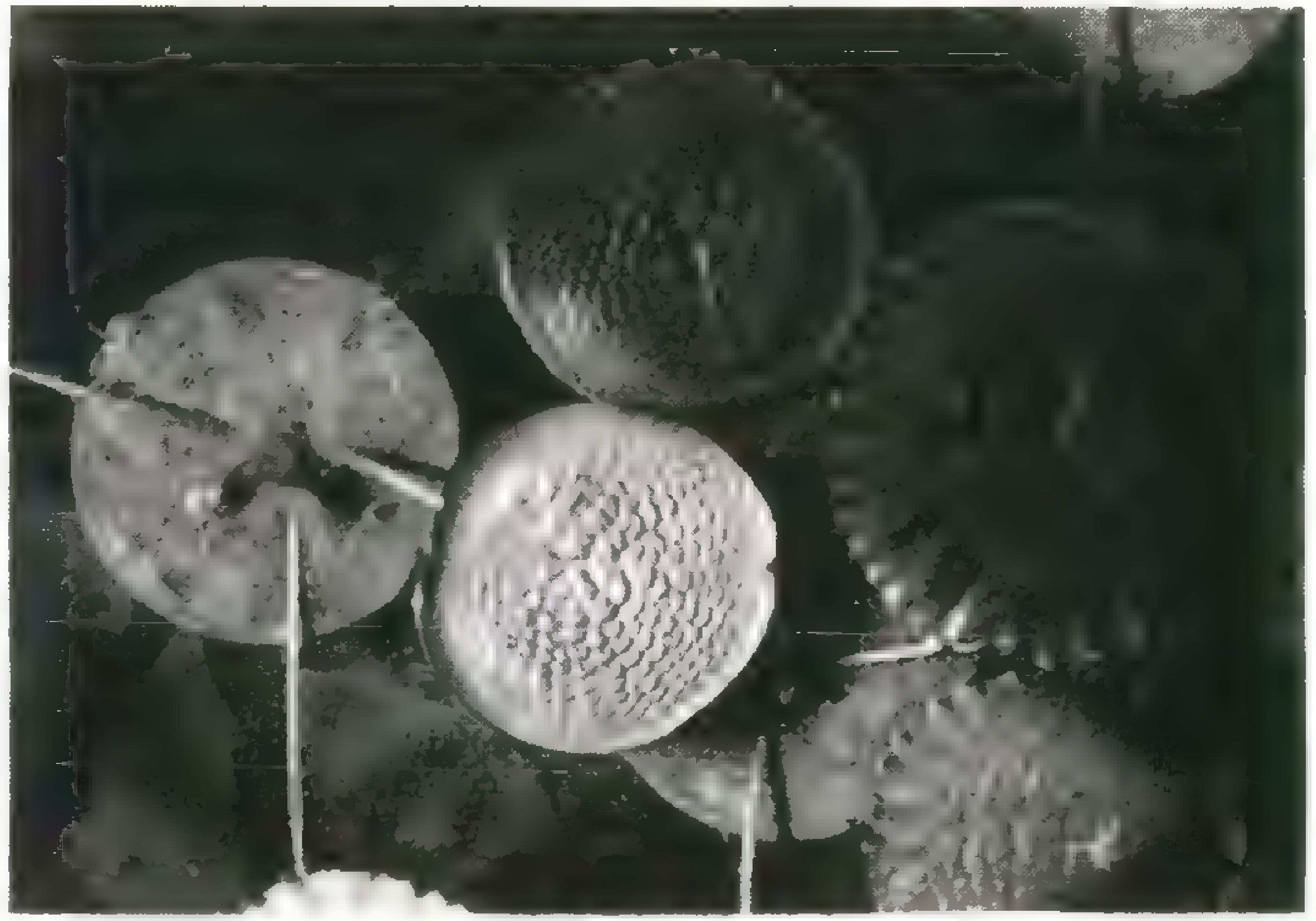
GREENHOUSE PROPAGATION



Seedling tank, showing steam controls.

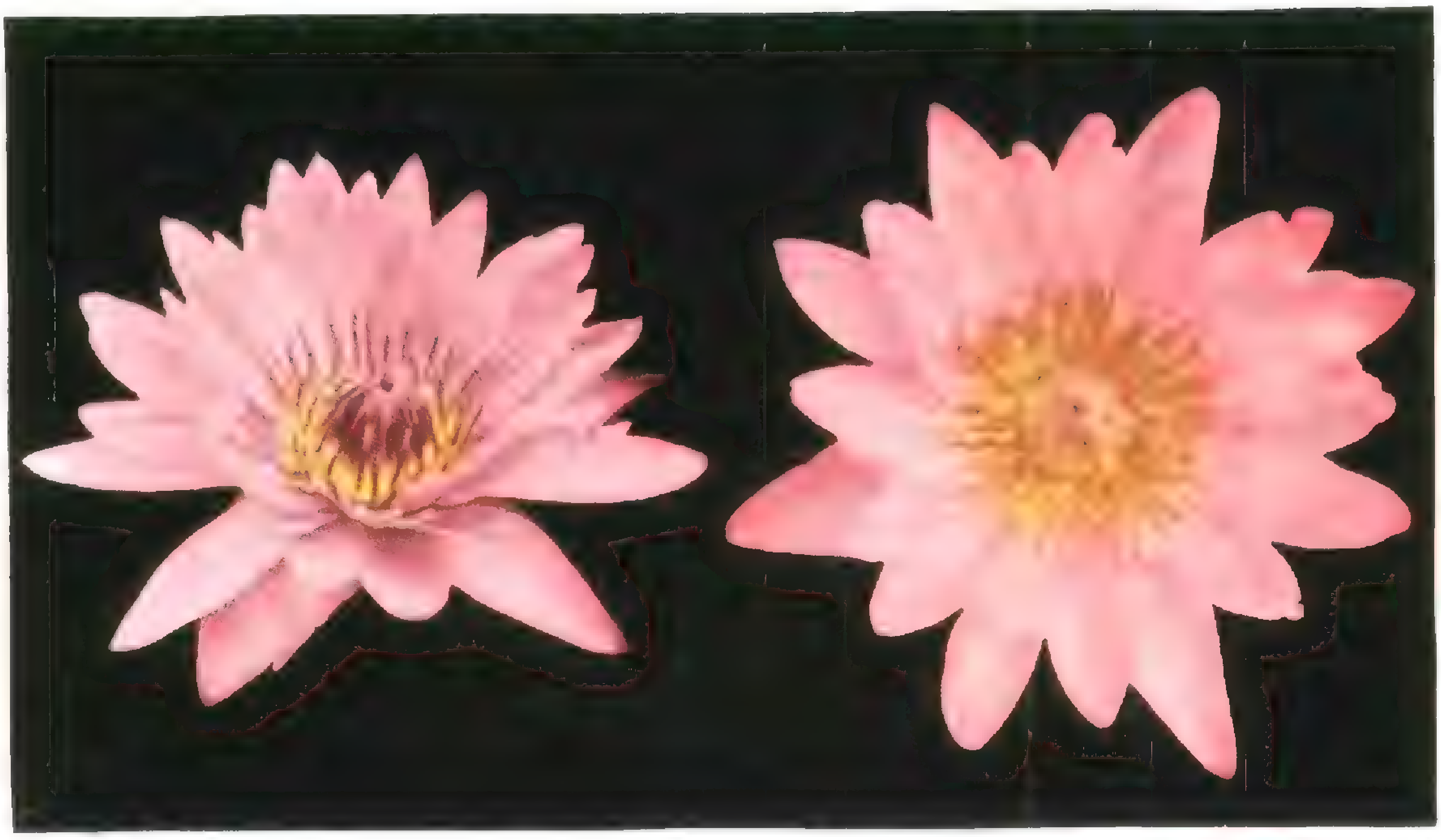
Seed germination.

Water lilies ready for planting out.

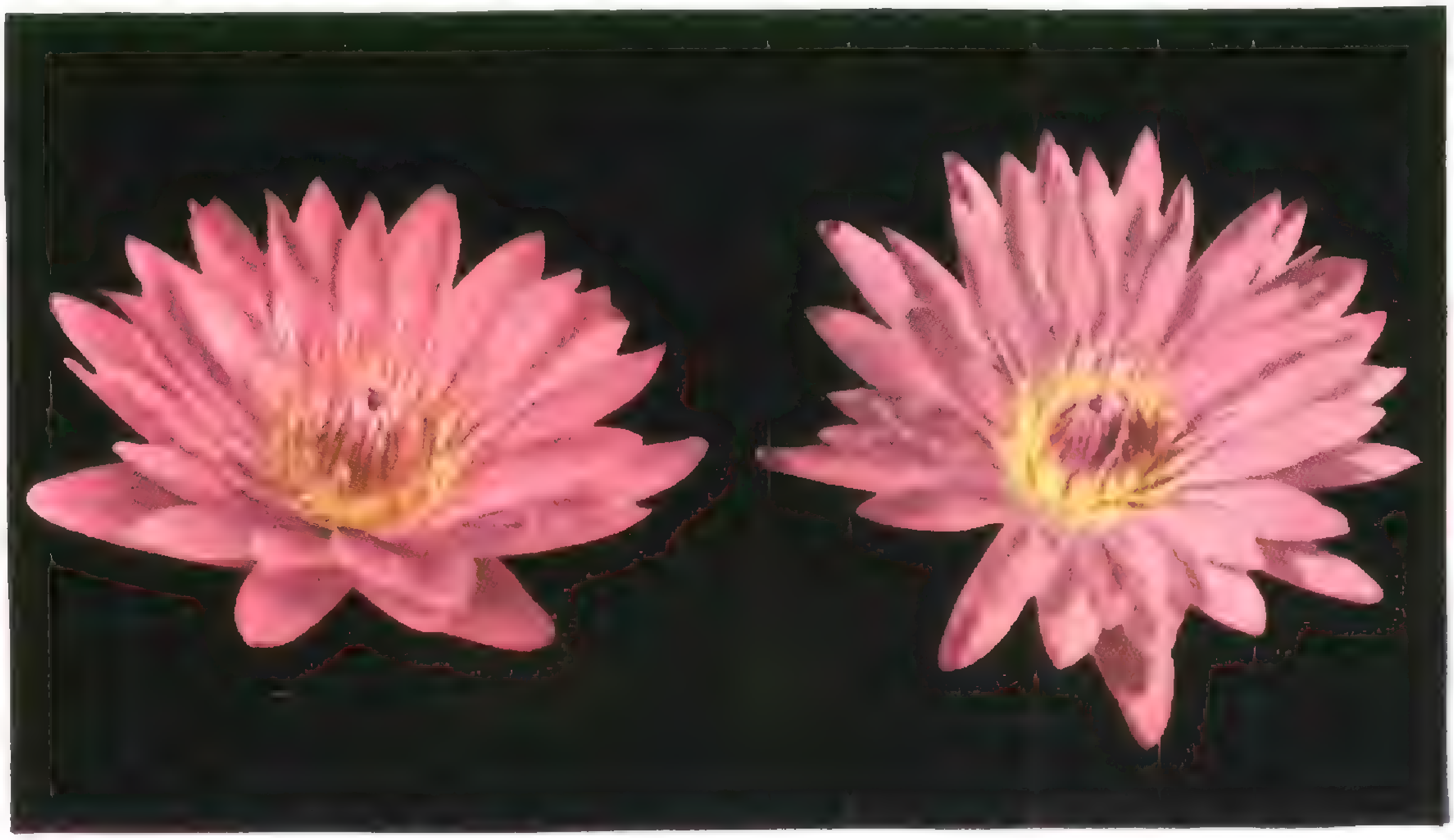


Victoria Cruziana ready for planting out.

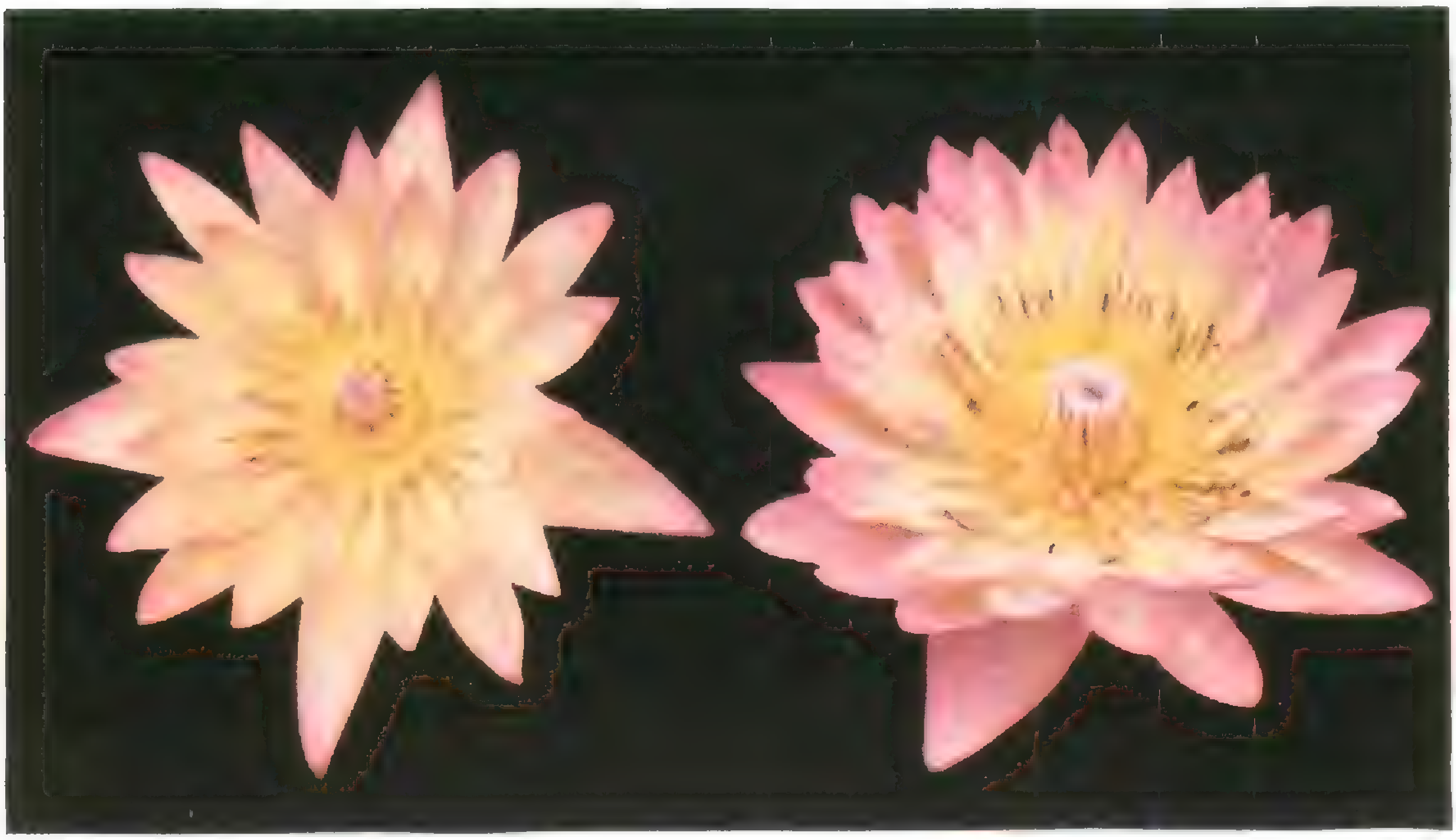
GREENHOUSE PROPAGATION.



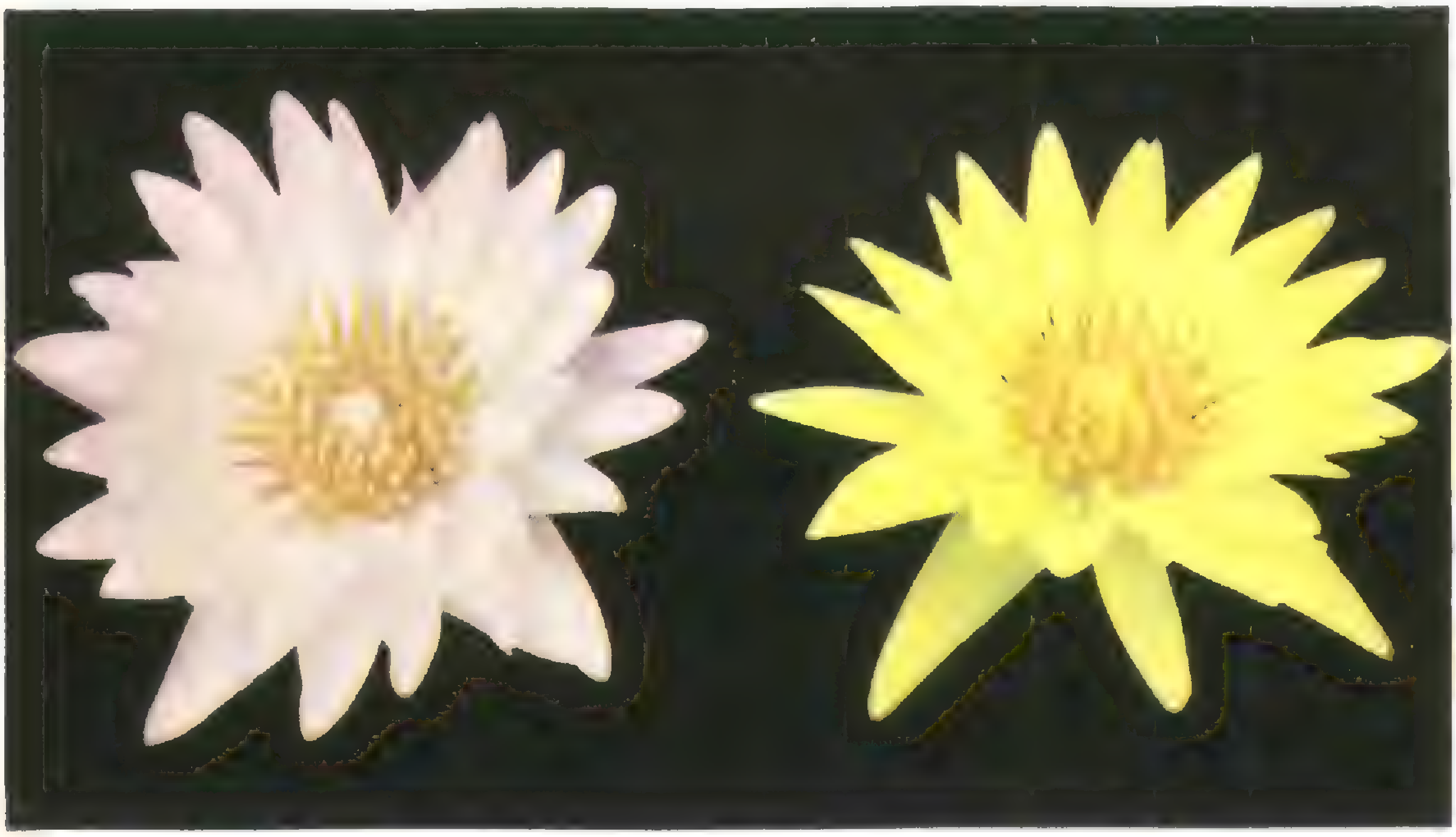
Shell Pink Wild Rose



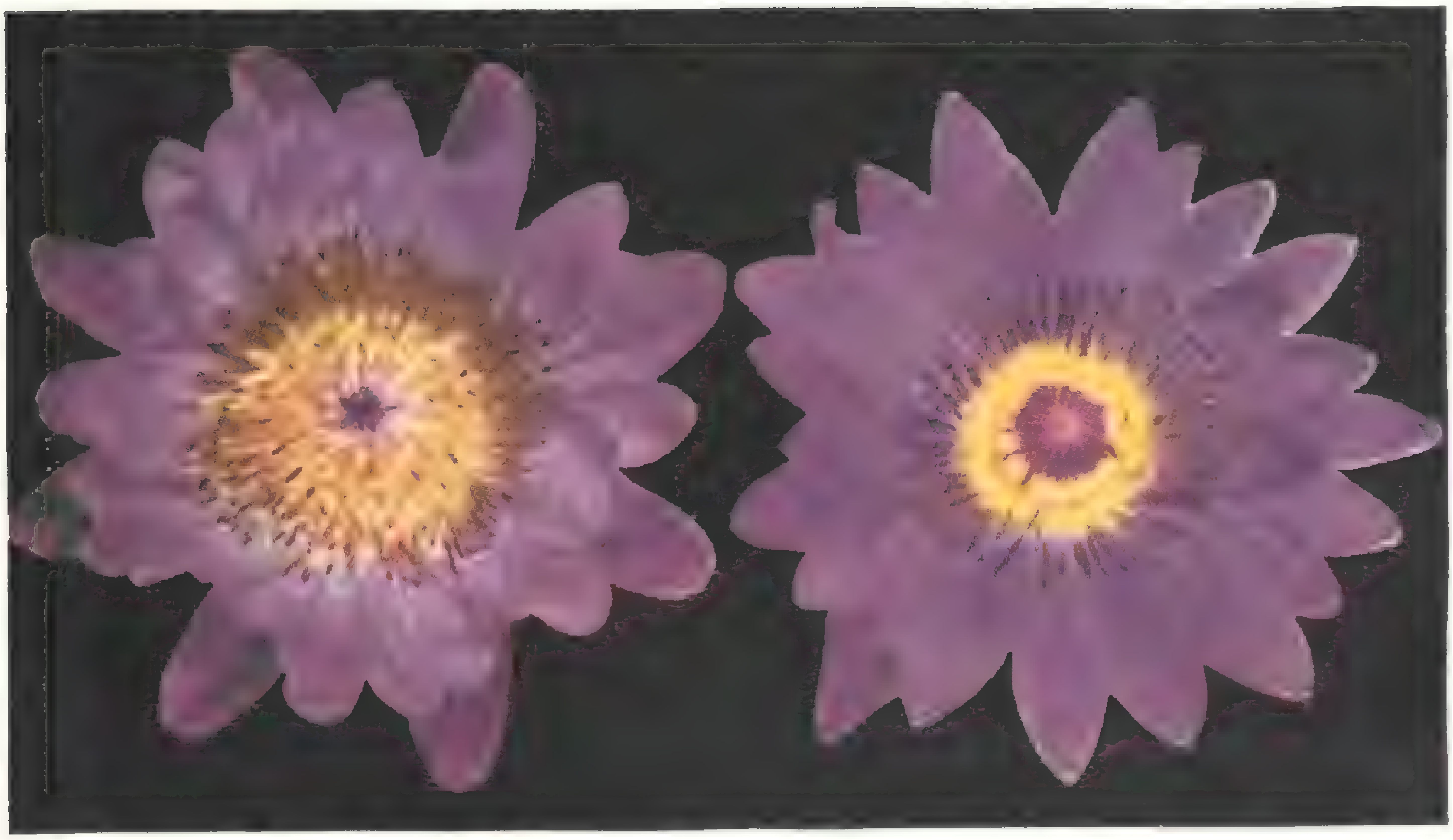
Rio Rita Pink Platter



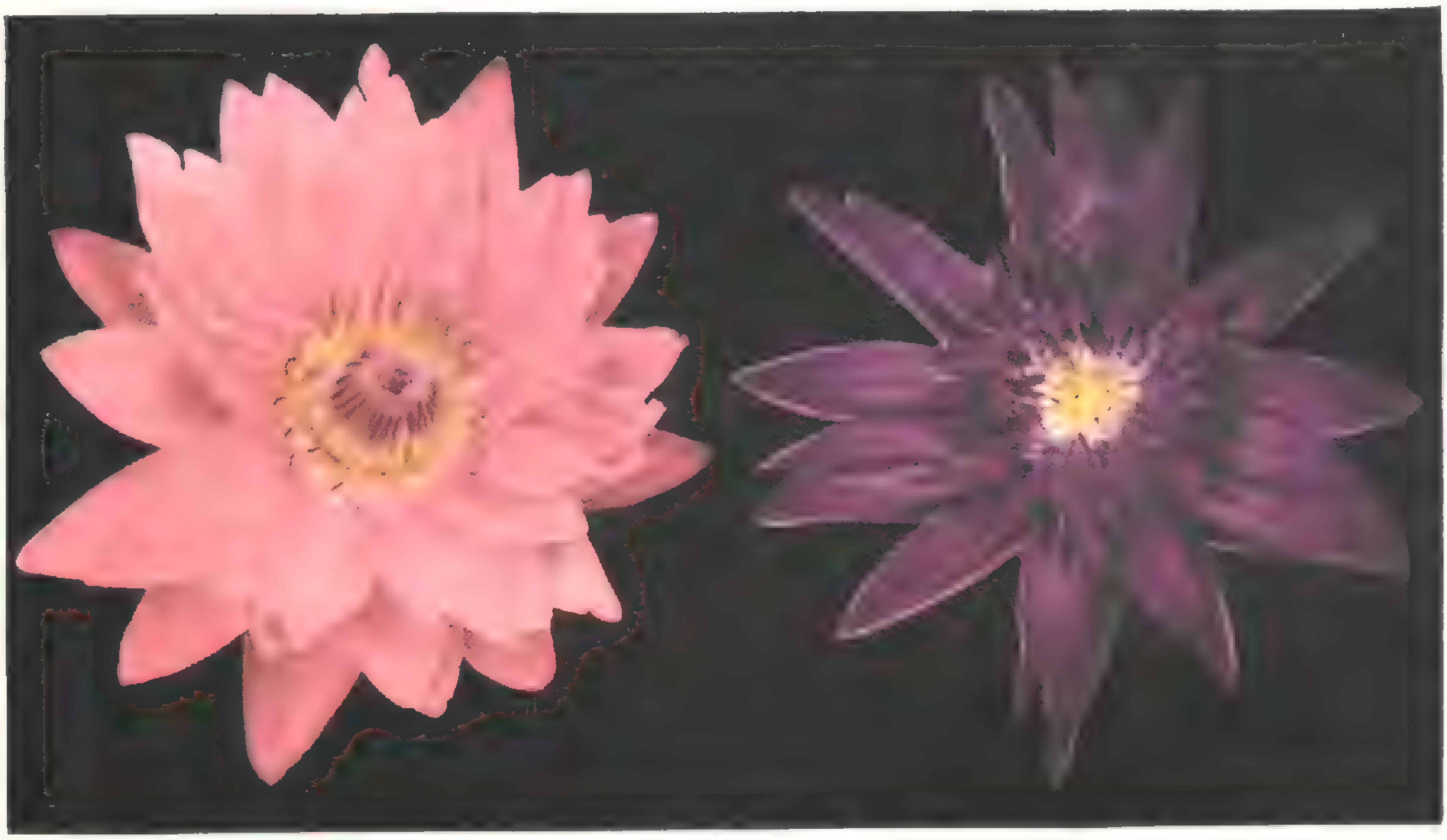
Talisman Peach Blow



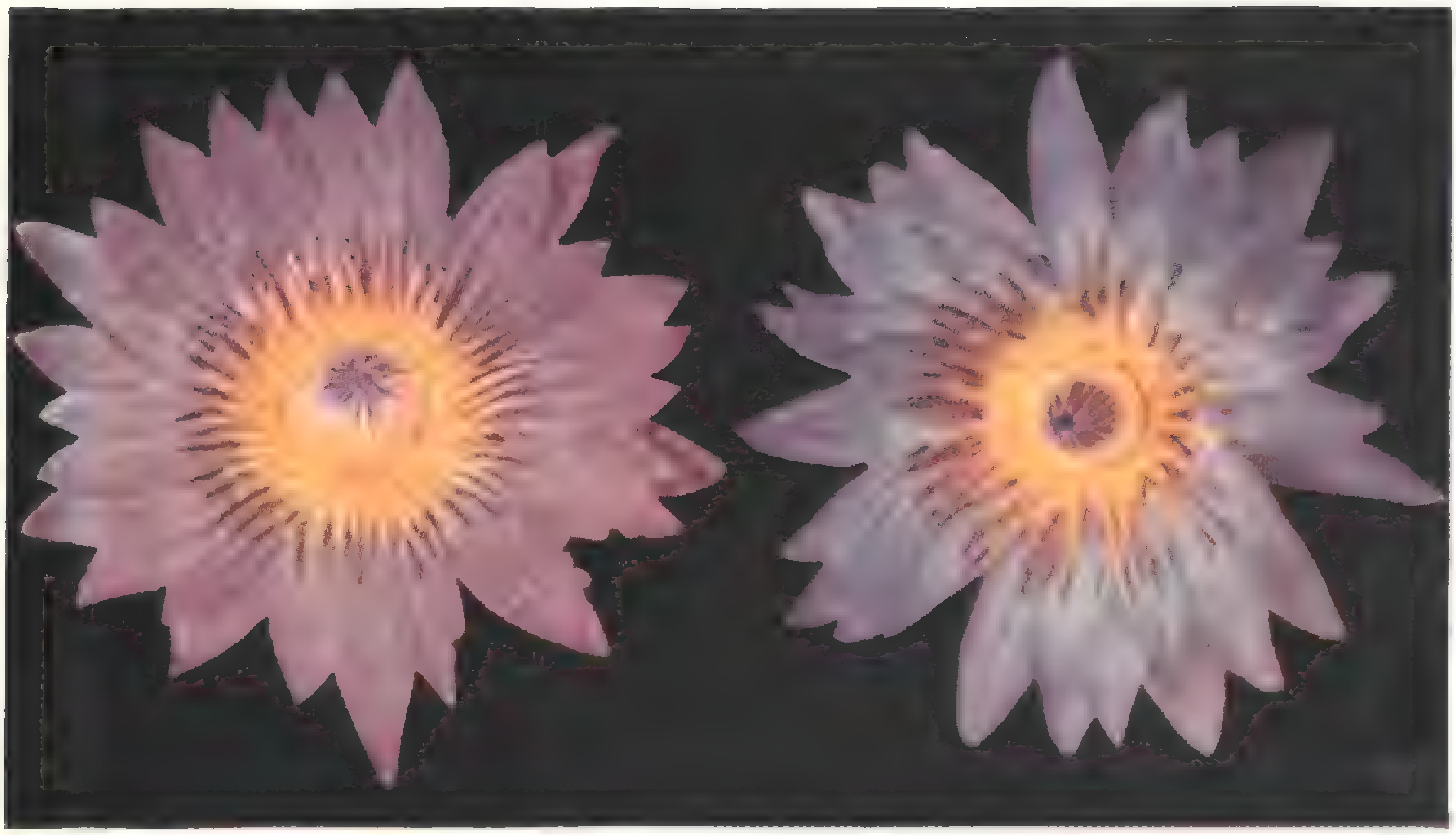
Isabelle Pring Sunbeam



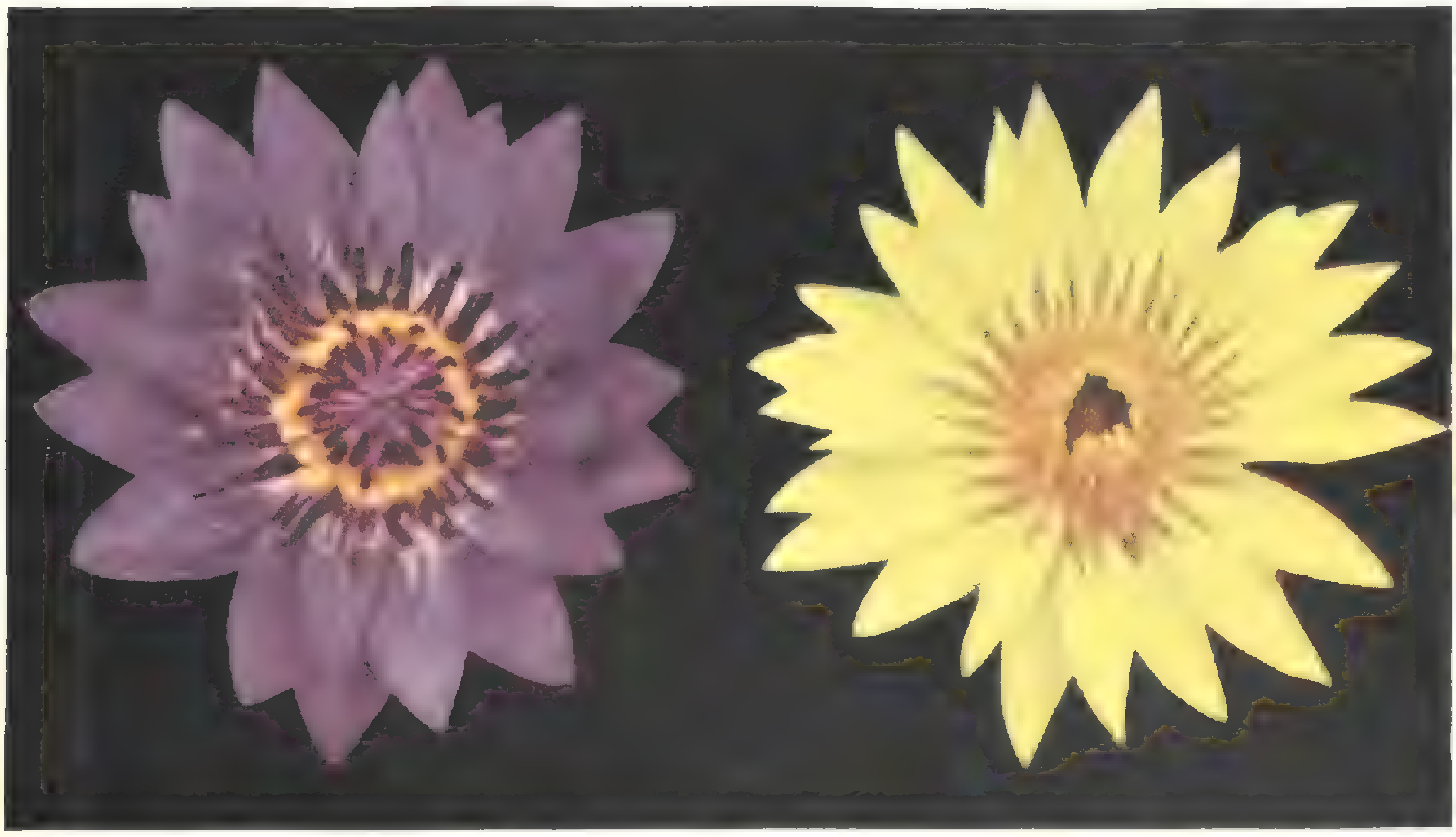
Judge Hitchcock Director George T. Moore



Persian Lilac Midnight



Bagdad Celeste



Nymphaea colorata African Gold

grown in the usual fashion, and instead of one large plant with smaller flowers, several plants with large, typical blooms and a better leaf pattern will be produced.

Since some water-lily fanciers may eventually want to raise lilies from seed, a few notes are here included. Remember that most of the seedlings will have to be discarded, either for lack of room, or, once they have bloomed, because of their inferior character. The flower to be chosen for seed-bearing must be protected from insect pollination to insure a pure cross, and must also be emasculated in the bud stage to avoid contamination from its own pollen. The first day that the cup-shaped center is filled with nectar is the time for pollination to take place. At the same time, anthers containing pollen from the chosen male flower should be removed and placed on the pistil of the selected seed parent. In order to exclude foreign pollen and to prevent premature dissemination of seed, tie a cheese-cloth bag over every bloom intended to be harvested. It is also helpful to tie a long string to the flower stem, attaching the other end to a stake near the crown of the plant, so that the pod can be readily pulled up for an occasional inspection.

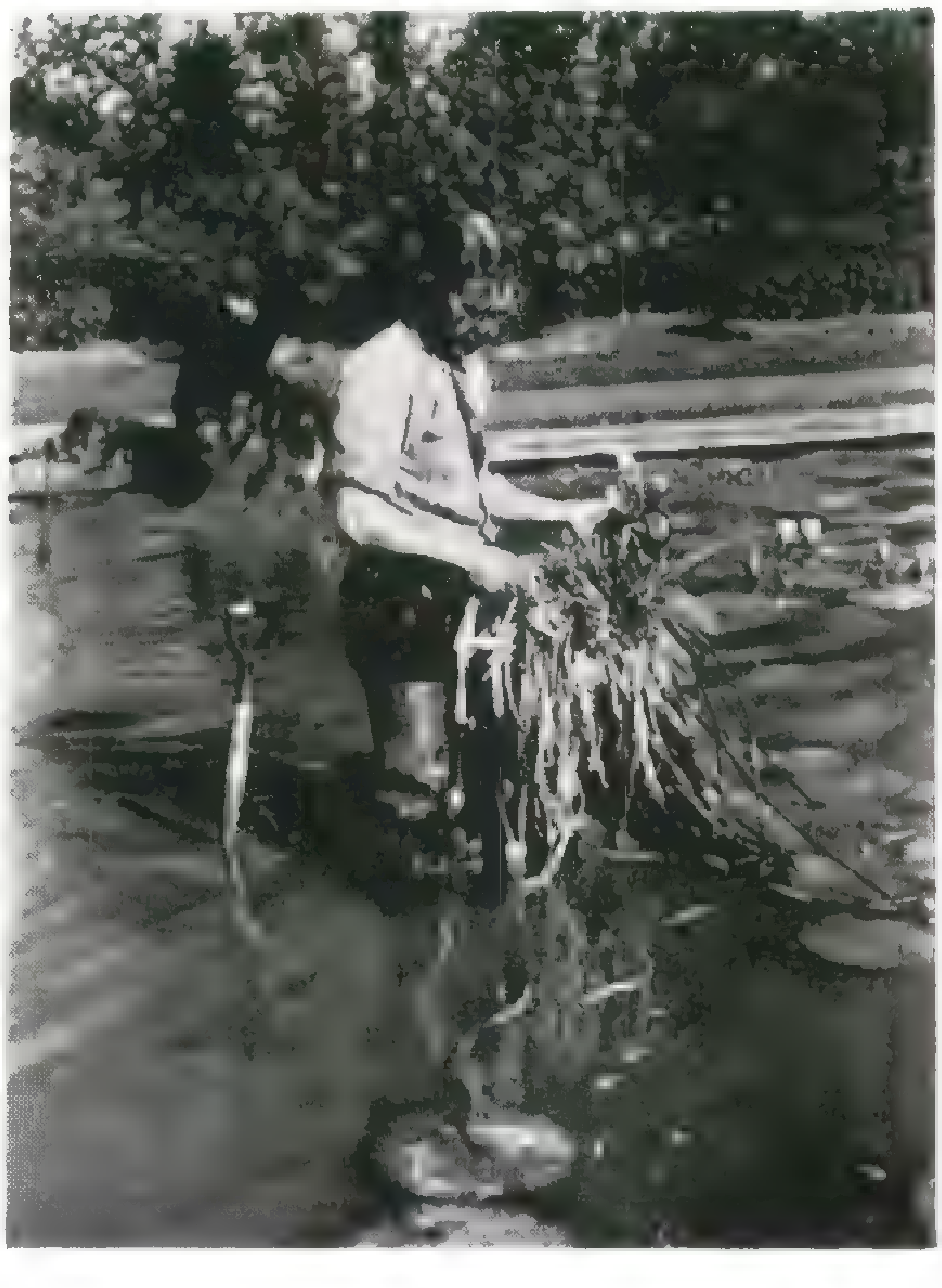
After pollination, an interesting maneuver takes place. The fertilized bud closes up tightly and makes a deep nose dive under the water's surface, thus preventing the drying out of the fertile seed. The vigor of this plunge is a good indication of just how successful the pollination has been. A flower which has merely finished its growth without being fertilized will fail to show this reaction. When the pod is ripe (usually about three weeks after pollination), it rises to the surface, and, unless the cheese-cloth covering has been attached with care, the seeds will be scattered over the pond.

Remove the ripe seeds and place them in a jar of water for about a week to allow the fleshy covering to disintegrate. Virile seeds, when fully ripe, sink to the bottom of the jar in a week or so, and should then be removed to prevent premature germination. When the seeds are dry and will separate readily, they may be sown at once in sandy soil covered with water. If large tanks are available, sow the seeds in shallow pans and immerse the pans in the tanks. But the amateur will find it more convenient to sow the seeds in small containers, such as a glass jar, to con-

Planting out in the spring.

Removing old leaves during the summer.

Digging up tubers in the fall.



Showing growth and roots of a single specimen planted out May 15 from a 4-inch pot.

OUTSIDE PLANTING

tain both the necessary two inches of soil and the water covering. For a larger seed crop, a pottery crock or even a half barrel might be used. These will permit the removal of enough seedlings for summer bloom in the pools, while the remainder can be left in the container and placed directly in the pool, to form tubers by fall. These may in turn be stored in moist sand for the following year's stock.

The seed-pans or containers must be kept at an even temperature of 75-80° F. Once the first floating leaves are developed, the plants may be potted up to grow through the winter. Keep at the same temperature and in full sun.

Notes for the would-be propagator.—Before use, the aquaria or the tanks should be thoroughly cleaned. Sterilize by scrubbing the interior with a strong solution of copper sulphate or permanganate of potash. When dry, paint the interior of the concrete or galvanized tanks with asphaltum paint. This treatment will retard the troublesome algal growth, and if the tanks are new the paint will prevent the leaching out of lye or acid, both of which are toxic to young lilies. The paint dries rapidly and the tanks may be filled within two days after application.

In potting young plants which have been segregated from the tubers, separate the roots so as to sift the soil between them. Leave the crown slightly above the soil and sand covering and about 1/4 inch below the pot rim. The plants may be started in 3- to 5-inch pots, depending on their size, but when well rooted a 5-inch pot is usually large enough to carry them through until planted outside.

A good soil mixture for the potted lilies is made from 4 parts good garden soil to 1 part of sand, fertilized with enough "Nitrophoska" to cover a dime. Other commercial fertilizers may also be used. Dehydrated cow manure (1 part manure to 10 parts of soil) is safer and easier to handle.

When transplanting into a larger pot, do not disturb the ball of soil, and do not press too hard or the wet ball will bulge above the new potting soil and tend to break the tender young roots. Keep the crown always above the soil but from 1/4 to 1/2 inch below the pot rim, and cover with 1/4 inch clean sand to prevent the soil leaching out when the pots are placed under water. If a 1/4-

inch space is left below the pot rim, this will allow for the soil expansion when submerged. Otherwise pushed-out soil will soon cover the bottom of the tank.

VIVIPAROUS VARIETIES

Until recently, the water-lilies which could be propagated from viviparous plants growing in the sinuses of the leaves were persistently smaller in bloom and of inferior color to those propagated by tubers. Ten years of research have finally produced a race of viviparous water-lilies equal in every respect to the non-viviparous types, and in some cases superior with regard to color. Those of the new viviparous hybrids now available for distribution are listed below.

Bagdad.—The combination of leaf and flower in this variety gives an extremely rich effect, something like that of a Persian rug, hence the name. The leaves are conspicuously and attractively marked with patches of dark reddish-brown. The broad flat flowers are borne closely above the leaves and are gold-centered with blue petals (Pale Wistaria Blue, Ridgway*). The plant is a good propagator, being strongly viviparous.

Celeste.—This variety has large flowers in a clear clean-looking blue which Ridgway designates as Wistaria Violet. When the flower is fully opened the rosettes of golden stamens in the center of the blue petals give a very attractive color effect. The plant is somewhat viviparous and propagates well from tubers.

Daisy (formerly No. 147).—This was the first large, white-flowered viviparous variety to be introduced. It has been named "Daisy" because, like the common English daisy, it is white-flowered in hot weather but in the fall when the nights begin to get cool the stamens and the tips of the petals are suffused with light pink. During extremely hot dry weather the flowers discolor slightly on the second day of bloom but as soon as cooler weather returns they remain clear and attractive for four to five days. The leaves are dark green, irregularly splashed with reddish-brown, and are light green underneath. The variety is very strongly viviparous and easy to propagate.

* Ridgway's color terms (Ridgway, Robert. Color standards and color nomenclature) are used in the descriptions.

Isabelle Pring.—This first large, pure white of the viviparous group is a fine, well-shaped flower, equal in size and color to the well-known variety "Mrs. G. H. Pring." There are many more petals, however, with less attenuated tips, which give the blooms an attractive, compact appearance, making a splendid display in the pool. The color remains a brilliant white, regardless of climatic changes, while the ease of propagation from the strongly viviparous leaves should make this a popular variety with both gardener and commercial grower.

Peach Blow.—This is one of the new departures in water-lily breeding, combining both pink and yellow in the same flower. The petals are very numerous (40-45) and are light pink at the tips (Pale Persian Lilac, Ridgway), shading gradually to yellow below. The numerous stamens repeat the color scheme and are yellow, tipped with light violet-pink. The variety is a good propagator, being strongly viviparous.

Pink Platter.—As the name indicates, this variety has a large flower which tends to open out very wide and flat. The petals are extremely numerous and are long and narrow. They are a light clear violet-pink (Pale Amaranth Pink, Ridgway). The plant propagates well from tubers and the leaves are viviparous.

Rio Rita.—This variety is such a brilliant deep pink that it could almost be referred to as red. The vivid coloring is heightened by the bright gold at the base of the stamens and by the different shades of pink in sepals, petals, and stamens. Ridgway designates the color in the sepals as Tyrian Pink, that in the petals as Amaranth Pink, and that of the stamens as Amaranth Purple. This combination of colors makes a very brilliant effect, particularly when seen against the light. The flowers have a very large number of petals and stamens. During cool weather they are kept from expanding fully by the large leathery sepals, and it therefore requires hot weather for them to be seen to best advantage. The plant propagates well from tubers and is weakly viviparous.

Shell Pink (formerly No. 104).—This variety was the first large-flowered viviparous hybrid to be produced and is still outstanding. It is similar to "General Pershing" but the buds are clear green and the leaf, instead of being suffused with copper color, is a clear green splashed with dull red. The flower is the lightest, clearest pink of any of the pink varieties and has no undertone of violet (Rhodonite Pink, Ridgway). It is also rather unique in the way its petals fit together into a large open bowl. Though not strongly viviparous this lily is enough so to be propagated satisfactorily.

Sunbeam.—This first pure yellow viviparous lily has excellent size and shape. Compared to "St. Louis" it is an even darker yellow, growing deeper in tone the second and third day. This good color, combined with its strongly viviparous character and consequent ease of propagation, makes it a distinct advance in the yellow water-lily field.

Talisman.—This has been named after the "Talisman" rose, since it possesses the same brilliant combination of yellow suffused and overlaid with pink. The flower is large and star-shaped, its ground color a clear light yellow (Primrose Yellow, Ridgway), which is strongly flushed with bright pink when the bud first opens. From the second day on, the pink spreads through the petals and the yellow intensifies, giving an apricot effect. "Talisman" is strongly viviparous.

Wild Rose.—The flowers of this variety make bright rosettes of pink and gold. The pink petals (Rosolane Pink, Ridgway) are flushed with yellow at the base, and in the center of the flower is an enormous mass of golden stamens lightly tipped with the same color as the petals.

NON-VIVIPAROUS VARIETIES

African Gold.—This variety can be most easily described as a very much improved *Nymphaea Burttii.* It has half again as many petals, a larger flower, and it propagates more readily from tubers. Compared to the variety "St. Louis," it is a much darker yellow (Reed Yellow, Ridgway).

Director George T. Moore.—This variety is one of a new race of hybrids between the older day-bloomers and the pygmy tropical species, *Nymphaea colorata.* Like that species, the leaves and flowers, though small, are borne in great profusion. Each plant makes a striking rosette of small leaves upon the water, from the center of which rise the numerous flowers, often 8-10 at one time. The flower is somewhat smaller than that of the other day-blooming tropical lilies but is still large compared to *N. colorata.* The rich purple of the petals is deepened and accentuated by the stamens, which are a dark purple even after opening, so that the flower carries its purple color better at a distance than does any other water-lily. It is an extremely good propagator.

JUDGE HITCHCOCK.—This variety might be described as a very much glorified *Nymphaea capensis.* In other words, it is large, cup-shaped, and violet-blue in general effect. Compared to *N. capensis* it is much larger, has many more petals (40-45) and is a deeper richer color. The richness of the color is due to the large number of stamens, which are gold tipped with blue, and to the fact that there are three distinct shades of blue in the flower: (1) on the inside of the sepals (Bradley's Violet, Ridgway), (2) on the petals (Wistaria Violet), and (3) on the tips of the stamens (Dauphin's Violet). This variety is a very good propagator from tubers and should make an excellent commercial variety from the nurseryman's standpoint.

MIDNIGHT.—This is double-flowered, an absolutely new break in water-lilies. The flowers are small and dark violet but open widely very early in the day, unlike its parent variety, "Jupiter." The flowers are fully double, all the stamens being replaced by petals which make a dark blue rosette in the center of the flower. In very hot weather the extra petals discolor at the tips by the second or third day, but in normal weather they remain attractive as long as the flower is in bloom. "Midnight" is another of the new hybrids with *N. colorata,* and, like all the varieties which have come from that species, it has numerous leaves and is very floriferous.

PERSIAN LILAC.—According to Ridgway, the color of this variety is Persian Lilac, which is a good description if one remembers that it is a pink-lilac and not a gray-lilac. The variety has so many petals that it could almost be called semi-double, and it is perhaps for that reason and because of its numerous golden stamens that it carries its color so well at a distance. The leaves are a clear light green above, contrasting pleasantly with the flower. The varieties, "Persian Lilac," "General Pershing," and

"Shell Pink," look particularly attractive when planted together. Though all are pink in general effect, their variable undertones of lilac and gold and their leaf colors produce a very rich combination.

YELLOW STAR.—This is the best yellow variety where water-lilies are being grown for mass display. The flowers are light yellow (Viridine Yellow, Ridgway), large, and are carried well up out of the water. The leaves are larger than those of any other yellow variety and make an attractive pattern below the flowers. This plant has fewer but longer petals than the variety "St. Louis" and they are taper-pointed, giving an attractive "sunburst" effect. G. H. P.

NOTES

Dr. George T. Moore, Director of the Garden, was interviewed over Radio Station WIL, February 6, on "Orchids."

Mr. A. P. Beilmann, Arboriculturist to the Garden, gave a talk before the Marguerite Krueger Conservation Club, February 22, on "Conservation."

Mr. George H. Pring, Superintendent of the Garden, has an article in the March number of *Real Gardening* (**3**:79-85) on "The Care and Feeding of Water-lilies."

Mr. Stanley Bettoney, Graduate Student in the Henry Shaw School of Botany, spoke before the St. Louis Academy of Science, February 26, on "The Use of Colchinine in Plant Culture."

Mr. Paul A. Kohl, Floriculturist to the Garden, gave a talk, illustrated with colored motion-pictures, on "A Tour of the Missouri Botanical Garden," before the Clayton Garden Club, February 21.

The December 1940 number of *Flower Grower* (**27**:55) has reprinted the article on "Identification and Control of Mealy-bugs" from the February 1940 Garden BULLETIN, by Dr. David C. Fairburn, Horticulturist to the Garden.

Dr. Hugh C. Cutler, Research Fellow at the Garden, who is collaborating with Dr. Edgar Anderson, Geneticist to the Garden, in a study of the genera Zea and Tripsacum, is spending some time at the Garden working over his collections of the plants.

The article from the March 1939 Garden BULLETIN, "Rediscovering the Rare Chinela," by Paul H. Allen, the Garden Representative in the Tropics, has been reprinted in the March number of the *Garden Digest* (**13**:29-32), under the title "How We Found the Rare Chinela Orchid."

Dr. Edgar Anderson, Geneticist to the Garden, in collaboration with Dr. Ernst Mayr, of the American Museum of Natural History, is giving the series of Jesup lectures at Columbia University, New York, March 4, 6, 11, 13, 18, 20, 25, and 27. The subject of the lectures is "Systematics and the Origin of Species."

The first number of Volume XXVIII of the ANNALS OF THE MISSOURI BOTANICAL GARDEN was issued in February. It contains a paper on "Some Effects of Carcinogens on Yeasts," by Carroll W. and Bertha S. Dodge and George Thomas Johnson, and "A Monograph of the Genus Parmelia in North America, North of Mexico," by Edward C. Berry.

The following papers by Dr. Edgar Anderson, Geneticist to the Garden, have recently appeared in scientific journals: "Edward Murray East (1879-1938)," in *Proceedings of the American Academy of Arts and Sciences* (**74**:117-118. 1940); Review of Richard Goldschmidt's "The Material Basis of Evolution," in *Chronica Botanica* (**6**:238-239. 1941).

Recent visitors to the Garden include: Dr. Ward M. Sharp, Refuge Manager, Valentine National Wild Life Refuge, Valentine, Nebr.; Dr. Carl C. Lindegren, Assistant Professor of Bacteriology, University of Southern California, Los Angeles, Calif.; Dr. E. R. Spencer, Professor of Botany, McKendree College, Lebanon, Ill.; Mr. LaMotte Kauffman, General Superintendent St. Paul Parks, St. Paul, Minn.; Dr. E. E. Naylor, Assistant Professor of Botany, University of Missouri, Columbia.

A paper on "Studies of the Biological Environment in Treated Wood in Relation to Service Life," by Henry Schmitz, Stanley J. Buckman, and Hermann von Schrenk (Pathologist to the Garden) appears in a recent number of the *Proceedings of the American Wood-Preservers' Association* (**37**:1-51. 1941). The paper had previously been presented at the annual meeting of the Association, Louisville, Kentucky, February 6.

Among the school groups visiting the Garden library and herbarium recently were: students in botany at Moberly Junior College, Moberly, Mo., in charge of Miss Esther Adams, Instructor in Biology; two groups of biology students from Principia College, Elsah, Ill., accompanied by Mr. John Wanamaker, Instructor in Biology; and the class in botany from Southern Illinois Normal University, Carbondale, Ill., with Prof. Walter B. Welch, Professor of Botany, in charge.

Mr. George H. Pring, Superintendent of the Garden, has given the following lectures recently: February 14, before the Alton Women's Council, at Alton, Ill., "The Relation Between Flowers and Insects"; March 2, at the Shaw Avenue Lutheran Church, "Plant Curiosities"; March 4, at luncheon of the Inspirational Club, Railroad Branch of the Y. M. C. A., "Economic Plants"; March 4, St. Clair County Garden Club, East St. Louis, Ill., "Weed Clearance." He has also shown the colored motion-pictures representing "Four Seasons of Bloom at the Missouri Botanical Garden," before the following groups: February 17 and 18, at Atlanta, Georgia, at the Joseph Brown and O'Keefe High Schools, under the auspices of the Georgia Federation of Women's Clubs; and February 21, before the St. Louis Nature Study Society, at Harris Teachers College.

STATISTICAL INFORMATION FOR FEBRUARY, 1941

GARDEN ATTENDANCE:	
Total number of visitors	16,493
PLANT ACCESSIONS:	
Total number of plants and seed packets received as gifts	32
LIBRARY ACCESSIONS:	
Total number of books and pamphlets bought	19
Total number of books and pamphlets donated	42
HERBARIUM ACCESSIONS:	
By Purchase—	
Gray, Fred W.—Lichens, chiefly from West Virginia, Virginia, North and South Carolina	203
Looff, Ethel H.—Plants of Kodiak Island, Alaska	115

By Gift—	
Brenner, Louis G., Jr.—Plants of Missouri	3
Fassett, Norman C.—*Senecio pauperculus* Michx. from Ontario, Canada	1
Hubricht, Leslie—Lichens of Missouri	8
Oakes Ames Herbarium by Louis O. Williams—*Leochilus gracilis* Schlechter from Panama	1
Sellman, Mary H.—*Uniola paniculata* L.	1
Stevens, O. A.—Plants of Minnesota and North Dakota	2
By Exchange—	
Conard, Henry S.—Liverworts of Iowa	30
Field Museum of Natural History by Julian A. Steyermark—Plants of Missouri	2
Total	366

SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date to the death of Mr. Shaw, in 1889, the Garden was maintained under the personal direction of its founder, and while virtually a private garden it was, except at certain stated times, always open to the public. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was designated by Mr. Shaw as its official title and in his will and all of his writings he specifically referred to it as the "Missouri Botanical Garden." By a provision of Mr. Shaw's will the Garden passed at his death into the hands of a Board of Trustees. The original members of the Board were designated in the will, and the Board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provison of the will, the immediate direction of the Garden is vested in a Director, appointed by the Board of Trustees. The Garden receives no income from city or state, but is supported entirely from funds left by the founder.

The city Garden comprises 75 acres, where about 12,000 species of plants are growing. There is now in process of development a tract of land of over 1,600 acres outside the city limits which is to be devoted to (1) the propagation and growing of plants, trees, and shrubs, designed for showing either indoors or outside, at the city Garden, thus avoiding the existing difficulties of growing plants in the city atmosphere; (2) gradually establishing an arboretum as well as holding a certain area as a wild-flower reservation, with the idea that possibly at some future time this may become the new botanical garden.

The Garden is open to the public every day in the year except New Year's Day and Christmas—week days from 8:00 a. m. until sunset; Sundays from 10:00 a. m. until sunset. The greenhouses are closed every day at 5:00 p. m.

The main entrance to the Garden is located at Tower Grove Avenue and Flora Place, on the Sarah car line (No. 42). Transfer south from all intersecting lines.

STAFF
OF THE MISSOURI BOTANICAL GARDEN

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Field Museum Notes

For sale by the Missouri Botanical Garden. Price $3.00

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SPECIAL NUMBER, TWENTY-FIVE CENTS

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Missouri Botanical Garden Bulletin

Vol. XXIX APRIL, 1941 No. 4

GROWING PLANTS

In 1928 a BULLETIN on "Growing Plants from Seed" appeared. This proved to be one of the most popular BULLETINS ever published. Many horticultural magazines copied it, and one seedsman printed an edition of 15,000 for distribution to customers. Some eight years later a BULLETIN on "Plant Propagation" was issued which likewise met the needs of the amateur gardener. Both of these BULLETINS are out of print, but the demand for them continues. It is thought that a revised edition, bringing the information up to date and published in one BULLETIN, will be welcomed.

I. GROWING PLANTS FROM SEED

Upon turning the pages of the seed catalogues the imagination of the gardener is excited, and he sees in his mind's eye his beautiful garden the following summer. However, the gorgeous illustrations and the many glowing descriptions of plants often arouse higher expectations than he is able to achieve. So often he blames the seedsman for the poor quality of the seed when they fail to germinate, but the fault is really his in not knowing how to start the plants. It is true that old seeds sometimes find their way to various stores where they are kept from year to year, but if the seeds are bought from reliable firms or from racks where they are guaranteed to be fresh, failure to grow plants must be laid to ignorance of garden principles. The object of this article, with accompanying illustrations, is to help the home gardener with his problems in raising plants from seed.

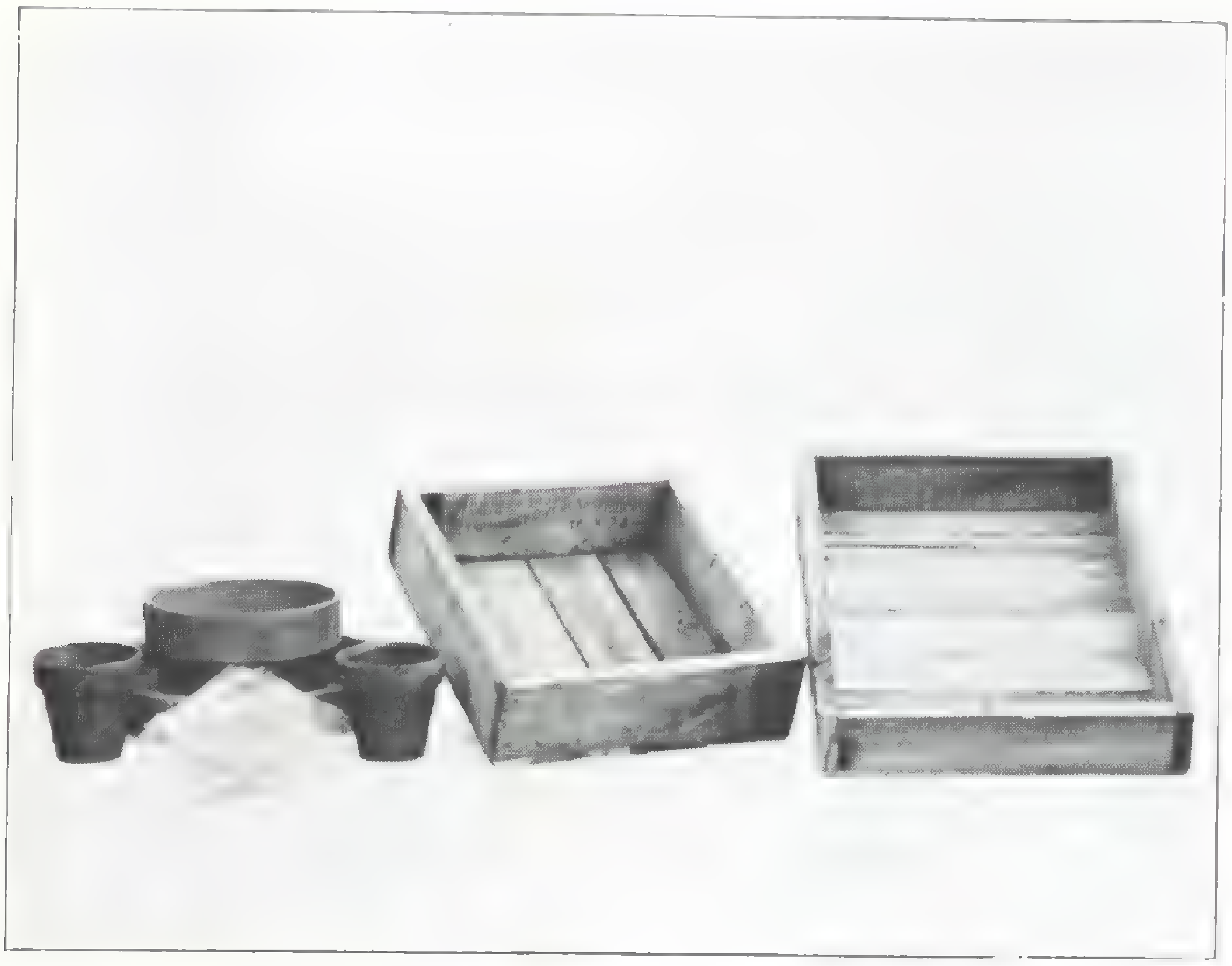
One small packet of a variety usually contains all the seeds necessary for the average garden if they are started indoors. If the seeds are sown directly outdoors allowance must be made for the many obstacles that often prevent the seedlings from getting a good start. Torrential rains frequently wash away seeds before they have had a chance to germinate. If the soil is very heavy or has been poorly prepared the seeds germinate, but the seedlings lack the strength to develop further.

As there always is some danger of cold weather up to the early part of May, it is best not to start the quick-growing kinds until a month or six weeks before time for planting outdoors. That means that most of the seeds should be sown toward the end of March and the beginning of April. Most perennials and those annuals that require a long period for their development may be sown in February. Such annuals are lobelia, pennisetum, petunia, salvia, snapdragon, verbena, and vinca.

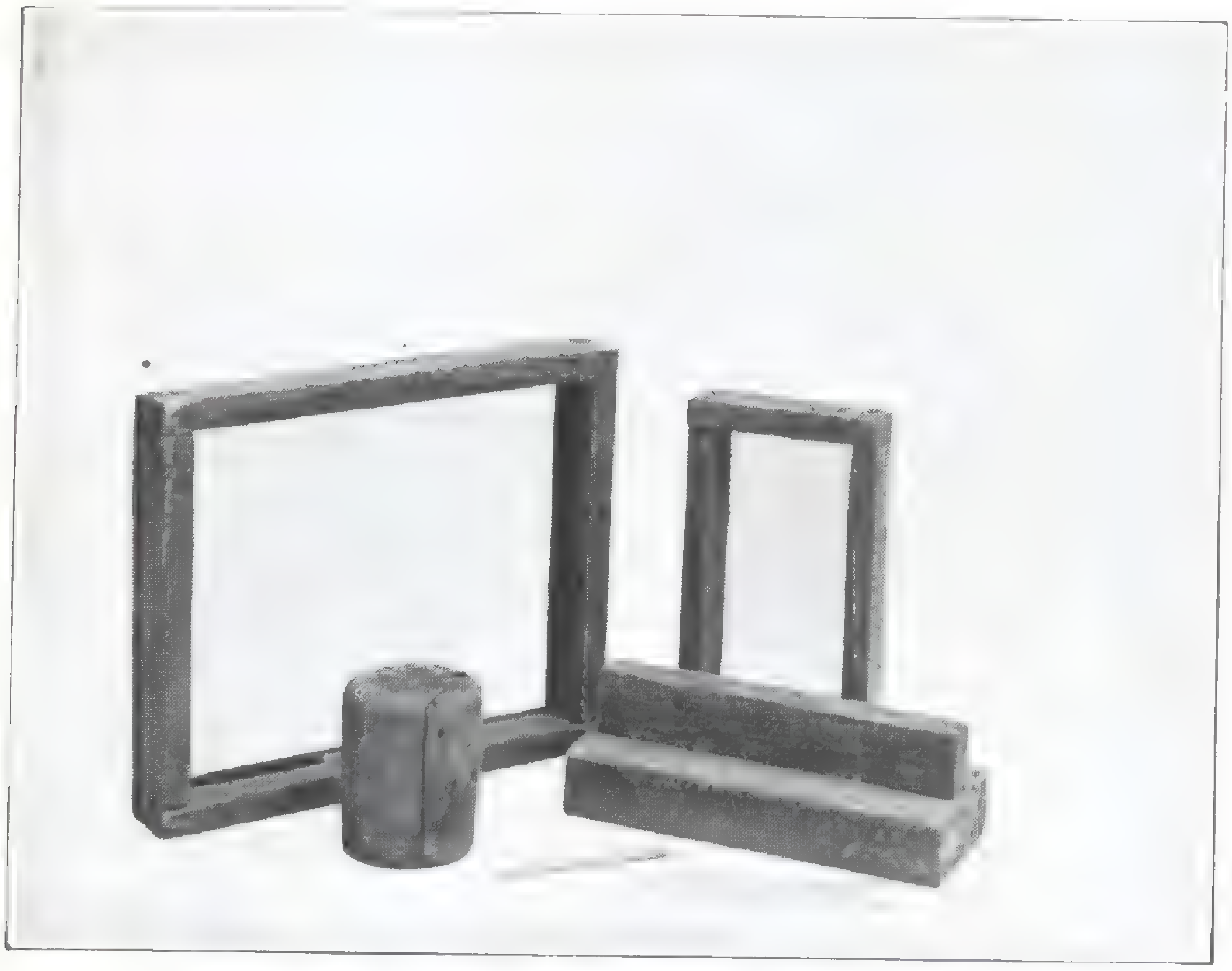
A small greenhouse is the ideal place in which to start plants early in the season but not everyone is fortunate enough to own one. The home gardener will, however, find a small cold-frame or hotbed indispensable, and such a frame can easily be made and covered with glass or one of the glass substitutes. If a frame is used very early in the season, say in February, then an electric hotbed cable with a thermostat will be required. If not used until after the middle of March there will be little need for additional bottom heat. Seedlings that are grown in frames are extremely sturdy, and for this reason plants are moved from a greenhouse to a frame for the hardening-off process before the final planting in the garden.

In placing the frame, a position should be chosen that is sheltered on the west and north by a fence, building, or shrubbery. The frame should have a slope to carry off the rain, and this slope should be to the south. If near-by buildings shade the garden during a part of the day, a position receiving the morning rather than afternoon light should be selected. When seeds are grown in the spring it is essential to secure as much sunlight as possible, but if they are sown in July and August the problem is to reduce the amount of sunlight. To accomplish this the frame is placed with the slope to the north and shades made from plastering laths are placed over it.

Sunlight is essential to the growth of plants. Seed may be sown in boxes or pots and set on any window sill. However, after



POTS, BOXES, AND COVER GLASSES



SCREENS, TAMPERS, DIBBER, AND LABELS

the seedlings are up they must be placed in some window receiving sunlight. A southern window is best, but if this is not available one with an eastern or western exposure will do, the former being preferable. The temperature of the room should be between 60° and 70° F. When the sun shines through the window-pane the temperature mounts considerably, but this will be for only a few hours. A little fresh air during this time will greatly benefit the plants. After the seedlings are started they should be placed in a small frame outdoors if possible.

Pots, boxes, etc.—Tin cans, cigar boxes, discarded granite ware, pots, and special boxes termed flats may be used in which to start seed (pl. 19, fig. 1). Boxes may be made of various sizes, but if very large they are heavy to handle when filled with wet soil. Two convenient sizes are 12 × 15 × 3 inches and 15 × 20 × 3 inches. A depth of 2½ inches is sufficient for the short time the plants are in the flats.

Drainage.—No matter what type of receptacle is used the bottom should have means to drain off the excess moisture. If the boxes are of wood several holes should be bored at the bottom or the boards should be spaced at least a quarter of an inch apart. If the boards of the flat are too close they will swell when moist and make the box water-tight. Any receptacle that does not permit the excess water to drain away will soon become waterlogged. The soil then becomes sour and the plants die. Even though provision for drainage is made it is well to place some coarse material in the bottom of the receptacle to prevent the fine soil from clogging the holes or cracks. For this purpose broken pieces of flower pots (termed crocks), gravel, stones, and cinders may be used.

Flower pots come in various sizes according to diameter. A four-inch pot is about the smallest size that should be used for sowing seed. When only a very small quantity of seed is to be sown it is best to use a flower pot, the seed being broadcast over the surface. If many kinds of seeds are to be sown, most of which will germinate in about the same length of time, much space can be saved by sowing them in rows in boxes.

Sieves, tampers, dibbers, labels.—Any one interested in growing plants from seed should secure some essential tools. They are all very simple and can be easily made. Sieves simplify the operation of sowing seed, especially fine seed, and once they are used they become a necessity. A fine-mesh screen need not be more than six or eight inches square, but a coarser one for sieving large quantities of potting soil should be one by two feet or larger. The fine screen may be made by tacking a piece of window-screen wire cloth to a wooden frame. For coarser screens wire screening 1/8-, 1/4-, or 1/2-inch mesh is used, the size of the mesh depending upon the nature of the soil and the purpose for which it is wanted. It would not only take a very long time to sift through a fine sieve all the soil necessary for some zinnias, but also it would not be best for the plants. Finely sifted soil packs with repeated watering, thus excluding the air. The soil then becomes sour and the plants grown in it become stunted.

Watering cans and methods of watering seed pots and boxes.—The average sprinkling can sold in the stores throws a rather coarse stream of water. Extremely fine seeds are barely pressed into the soil when sown and when watered with a heavy stream they are often washed away. Better types of cans may be purchased from seed stores and florists' supply houses. A rubber bulb sprayer, the kind used in the laundry, is a good substitute for a sprinkling can when only a few pots of seed are watered.

If a piece of moistened cloth is laid on the pot and the sprinkling done through the cloth, the force of the water is broken and the moisture oozes through to the soil. After enough water has passed through, the cloth should be removed. In order to prevent too rapid evaporation from the surface, the pots should be covered with a piece of glass or paper until the seeds germinate.

Types and sizes of seeds.—Seeds vary a great deal in size, shape, and the length of time required for germination. If the seeds of petunias and lobelias are covered with more than a quarter of an inch of soil, failure to germinate may be expected, but if barely covered or lightly pressed into the soil more seedlings will come up than can be used. Seeds that are sown on the surface of the soil indoors or in a frame where practically all conditions of soil, moisture, light, and heat can be controlled will germinate readily, but if this were done in the open failure would result.

There is a certain relation between the depth that seeds are sown and their power to germinate. Seeds are frequently sown too deeply. Those covered with much soil do not get the proper amount of air and have the added burden of pushing up the layer of soil above them. Air (oxygen) is absolutely necessary for the germination of seeds. All small seeds should barely be covered, just enough fine soil or sand being passed through the sieve to conceal them. In sieving soil or sand over small seeds the sieve should be held not more than an inch or two above the surface of the soil. If held higher, the particles of sand or soil striking the seeds will cause them to jump in all directions, with the result that some of them will still be on the surface, or some will have a light covering and others a heavy one. This will result in an uneven and many times poor germination. In sowing fine seed the tendency is to make the soil too fine. The finer the particles the more compact the mass of soil will become, and after wetting, such soil will bind and become hard. When fine seeds are sown upon such a surface their delicate roots experience great difficulty in penetrating the hard surface. They generally remain stunted at the surface and finally succumb. Fine seeds sown upon a rough surface are more apt to grow. Larger seeds, such as coreopsis, hollyhocks, asters, and cornflowers, may be sown somewhat deeper, being covered with about a quarter of an inch of soil.

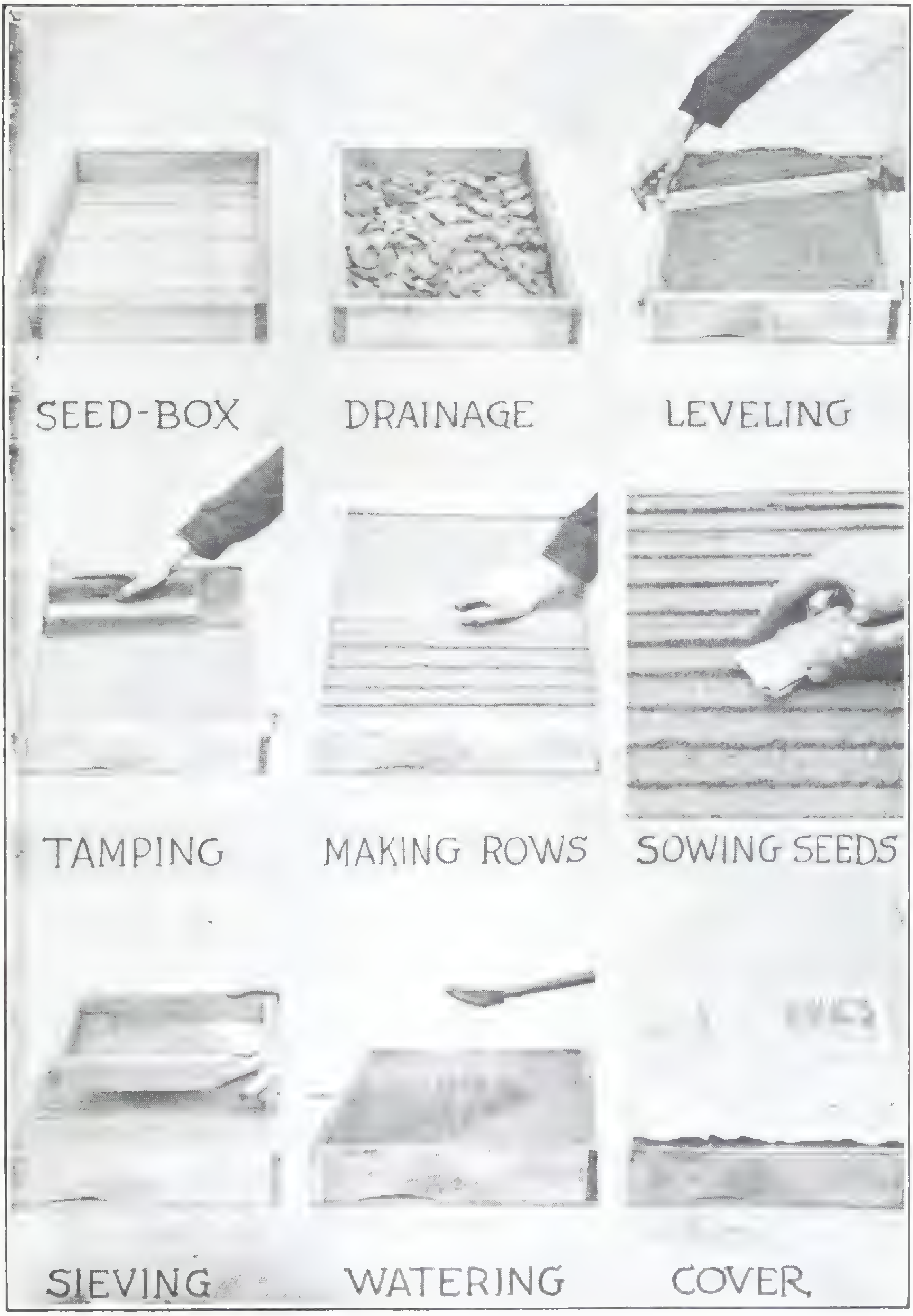
Soil medium in which to sow seeds.—Most seeds have been and probably always will be sown in soil. It is the commonest material available and gives good results. The best soil for the purpose is composed of about one part loam, one part leaf-mold, and one part sand. By loam is meant a soil that contains a liberal amount of vegetable matter in the form of decaying roots, leaves, etc.

Sand has always been considered one of the best materials in which to sow seeds if it is washed or sterilized. There formerly were two objections to the use of sand for seed sowing; first, it lacked any food to promote growth after the seedlings germinated, and second, it dried out rapidly. The first objection can now be dismissed if the seedlings are fed in a manner similar to that employed in the soilless culture of plants. In recent months the new method of watering house plants by means of an asbestos wick in the bottom of the pot has been advocated, and while we have not had the opportunity of giving this method a trial with sand it probably would keep it uniformly moist. Seedlings germinate more uniformly in sand than in soil, and have less difficulty in pushing up. Those sown in soil and covered with a layer of soil, or those planted close together often push up a whole crust of soil, much to their detriment. Seedlings are much more easily separated for transplanting when grown in sand than in soil. Because sand drains so readily it always warms up more rapidly and this hastens germination. If the sand is dirty, it should be washed. To do this, a bucket is filled about half full of sand and water run in through a hose. The dirt, being lighter than sand, will float and will be carried over the top of the bucket. Moving the hose about will rapidly free the dirt, and when the water is clear the sand is clean.

Seedlings are always subject to the ravages of the damping-off disease. The thread-like parasite spreads over the surface of the soil and may destroy a crop of seedlings over night. This disease is always associated with a great amount of humidity, and on that account seedlings just germinating should never be watered toward evening. If seeds are sown in sand instead of soil there is much less danger from attacks of the damping-off disease. One of the chief reasons why sand is so much better than soil for sowing seed is that it does not retain as much moisture, even though it is watered more frequently. Seedlings will be lost by the damping-off disease, even when seeds are sown in sand, if they are crowded or if the air about them is very humid. This humid condition can easily be created if the cover-glass or paper is left on the boxes or pots after the seedlings are up. Various precautions should be taken to prevent the spread of damping-off disease. Clean receptacles should always be used; pots should be washed and boxes brushed. Undoubtedly steam sterilization will help to prevent damping-off, but practically no amateur is equipped to use that method unless he has a steam-pressure cooker. Heating the soil in an oven will kill many disease spores, but the odors will drive the family from the house. Boiling water poured over the surface before sowing the seed will help. If boiling water is used the soil must be left to dry for a day or two, because working wet soil will cause it to puddle, much to the detriment of the seed sown. None of these methods or materials will prevent damping-off if the other essentials of careful watering, ventilation, or the admission of light are disregarded.

Sowing the seed.—Plate 20 shows the essential operations in the sowing of seed in boxes, and with few exceptions the same methods hold for pots or any other receptacle. As previously mentioned, the box should have holes or cracks in the bottom. The first step is to cover these openings with broken crocks, stones, etc. The box should then be filled to overflowing with sand or soil, leveled with a stick, and tamped lightly. The surface of the soil will then be about $\frac{3}{8}$ of an inch below the top edge of the box. If the soil or sand is an inch below the top of the box much trouble may be anticipated with the damping-off disease due to the poorer air circulation. After the soil is tamped, the rows are marked with a stick or plant label, the stick being pressed into the surface to the depth wanted for the seed. For fine seeds the surface is barely marked, for large seed a deeper trench is required. Before making the rows the soil or sand must be moist, for if dry it immediately rolls back in the trench when the stick is withdrawn. After the rows are made the seed is ready for sowing, and for convenience one corner of the seed packet is torn off and the packet lightly tapped to secure an even distribution of the seed along the rows. It is best to allow one row for each kind of seed, or at least one-half row for a kind. In this way the label can be placed either at the beginning or at the end of the row. If labels are placed in the rows they will interfere with the glass or paper cover.

A mouse can do much damage in a pot or flat of seed in one night, so the pot or box should be covered with a sheet of glass or a board. After the seeds have germinated and are growing there is seldom any danger from mice. While on the subject of losing seed by other means than the damping-off disease it might be well to warn against the cunning antics of ants. Ants will carry away any seed that is not too large for them to handle. They prefer seeds just as they are germinating, but will also take newly sown seed. As they are wont to lick anything, be it insect or seed, that exudes a sweet substance, they supposedly carry the seed to their nests. They will sometimes appear when least expected. If they are in the neighborhood of a box of seed it is well to place


SEED-BOX
DRAINAGE
LEVELING
TAMPING
MAKING ROWS
SOWING SEEDS
SIEVING
WATERING
COVER

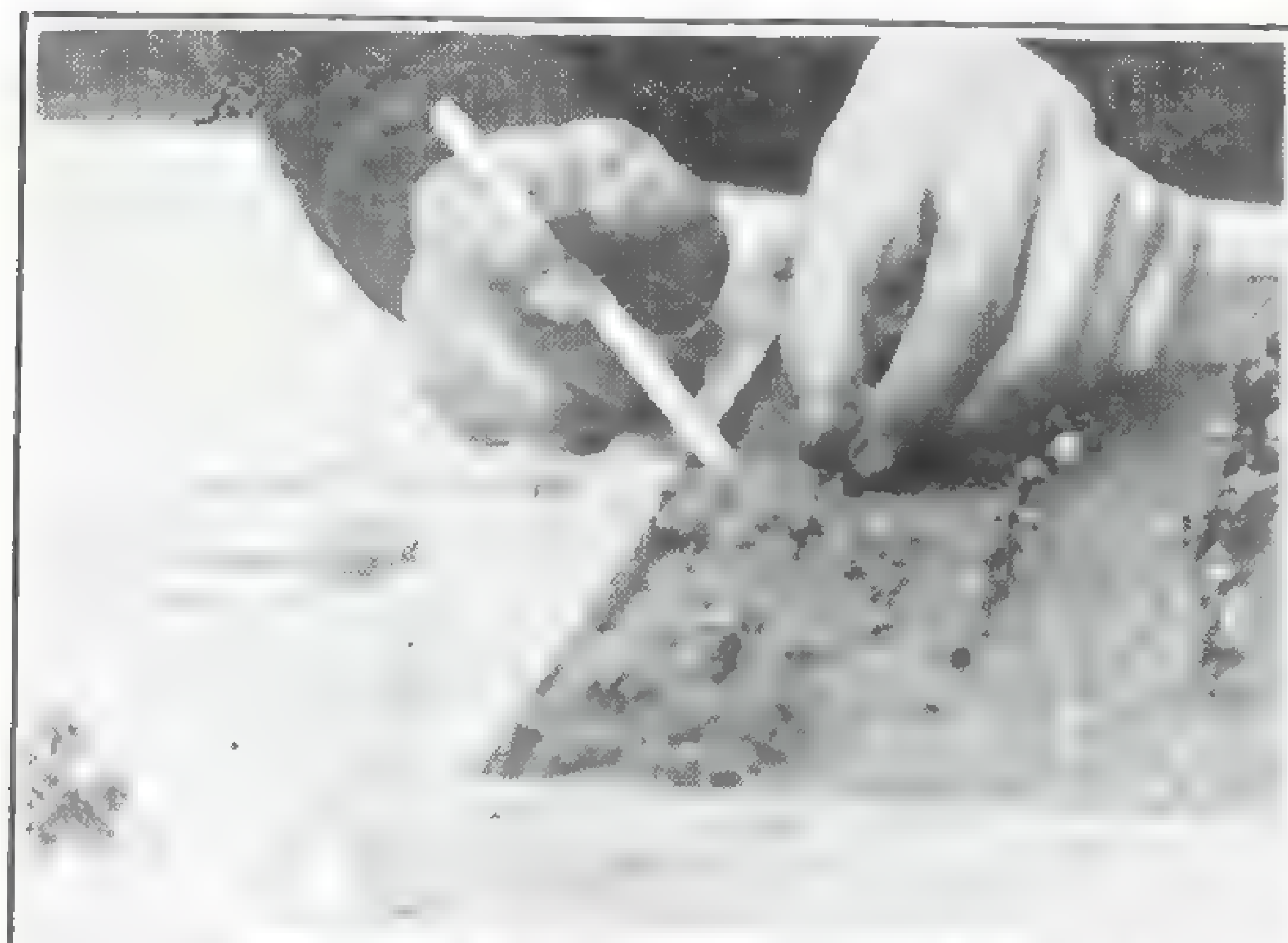
SEED SOWING OPERATIONS

a water barrier between them and the seed box. Placing the boxes on inverted flower pots set in one or more saucers of water will prevent the ants from causing any trouble. If only a pot of seed is to be protected it may be stood on a half brick in a saucer or pan of water. If many pots or boxes are used they may be set on a platform supported by standing four bricks in water.

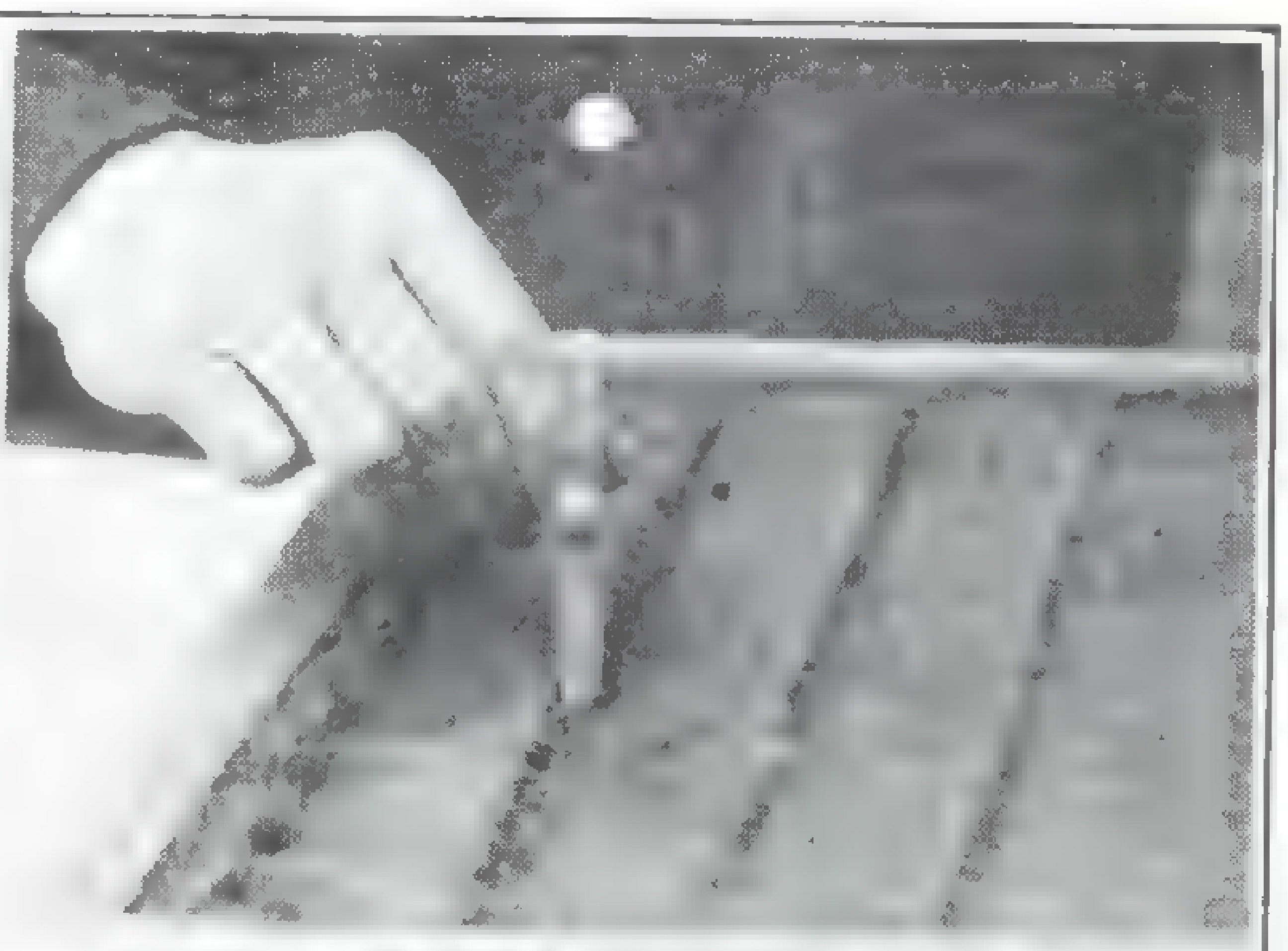
After all the seeds are sown sand is sieved over the rows. Some sand should have been set aside to dry, so that it would run through the sieve easily. The deeper rows containing the large seeds should receive a heavier covering than the small ones in the shallow rows. After the seeds are all covered the flat is watered and then a pane of glass or a piece of paper or both are placed over the box. Moisture will accumulate on the glass and should be removed each morning. If the glass is carefully removed from the pot and held by one corner, the water will run off quickly. If the glass is carelessly removed the large drops of water will splash fine seeds in all directions. When the seeds begin germinating the glass or paper should be raised slightly at one side to admit air, and after the seedlings begin pushing through, the box should be uncovered. A great many seedlings will be lost if the cover is left on too long. The close atmosphere under the cover is ideal for the spread of fungous growths.

Eight operations in transplanting seedlings.—After the seedlings are up and are sufficiently large to handle they are ready for transplanting. Removing seedlings from their boxes should not be postponed too long. While seeds should not be sown thickly they are always more or less crowded in the boxes or pots and should be separated from their neighbors as soon as possible. Plate 21 illustrates the various operations in transplanting seedlings. The majority of seedling plants are sufficiently large to be handled with the fingers. They either have a leaf large enough to act as a handle or are strong enough to be held by the stem. Whenever possible a seedling should be held by the leaf, as then there is less danger of crushing the tender plant. Some seedlings, notably petunias, lobelias, begonias, etc., are so very small that it is impossible to handle them with the fingers. The last three figures of plate 21 show how minute seedlings are handled.

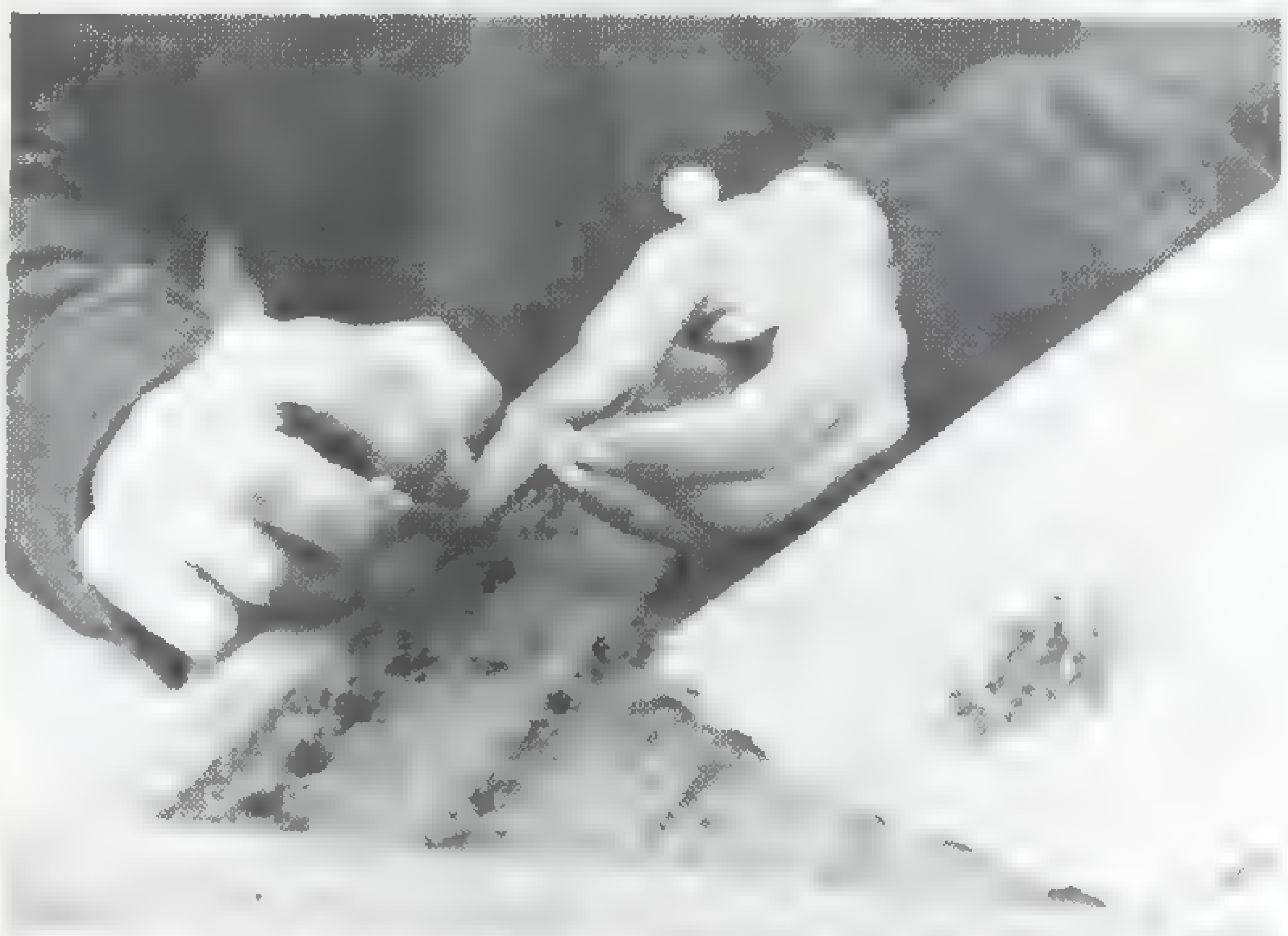
The box into which the seedlings are to be transplanted should contain some drainage material and should be filled up with a



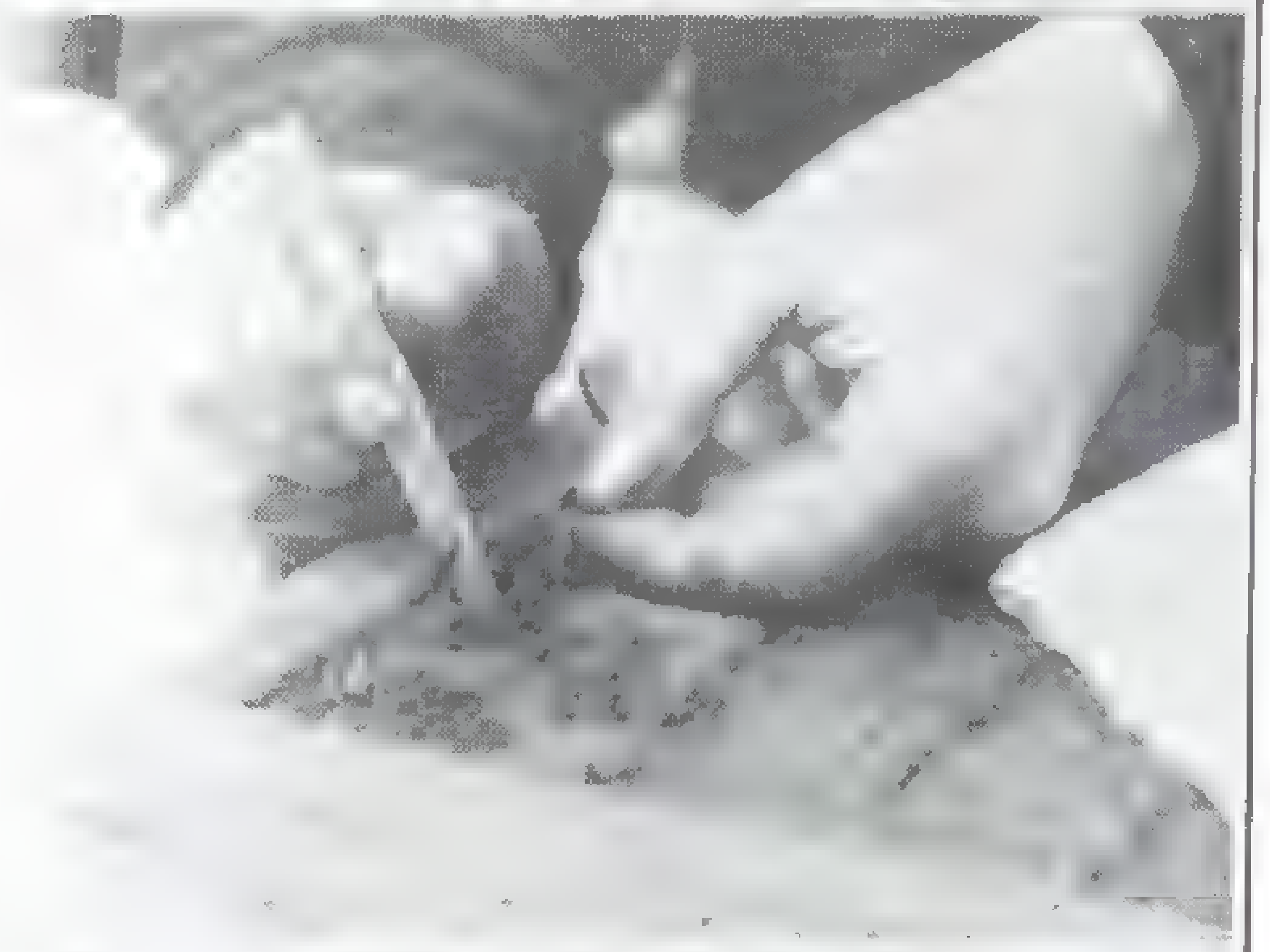
LIFTING SEEDLINGS



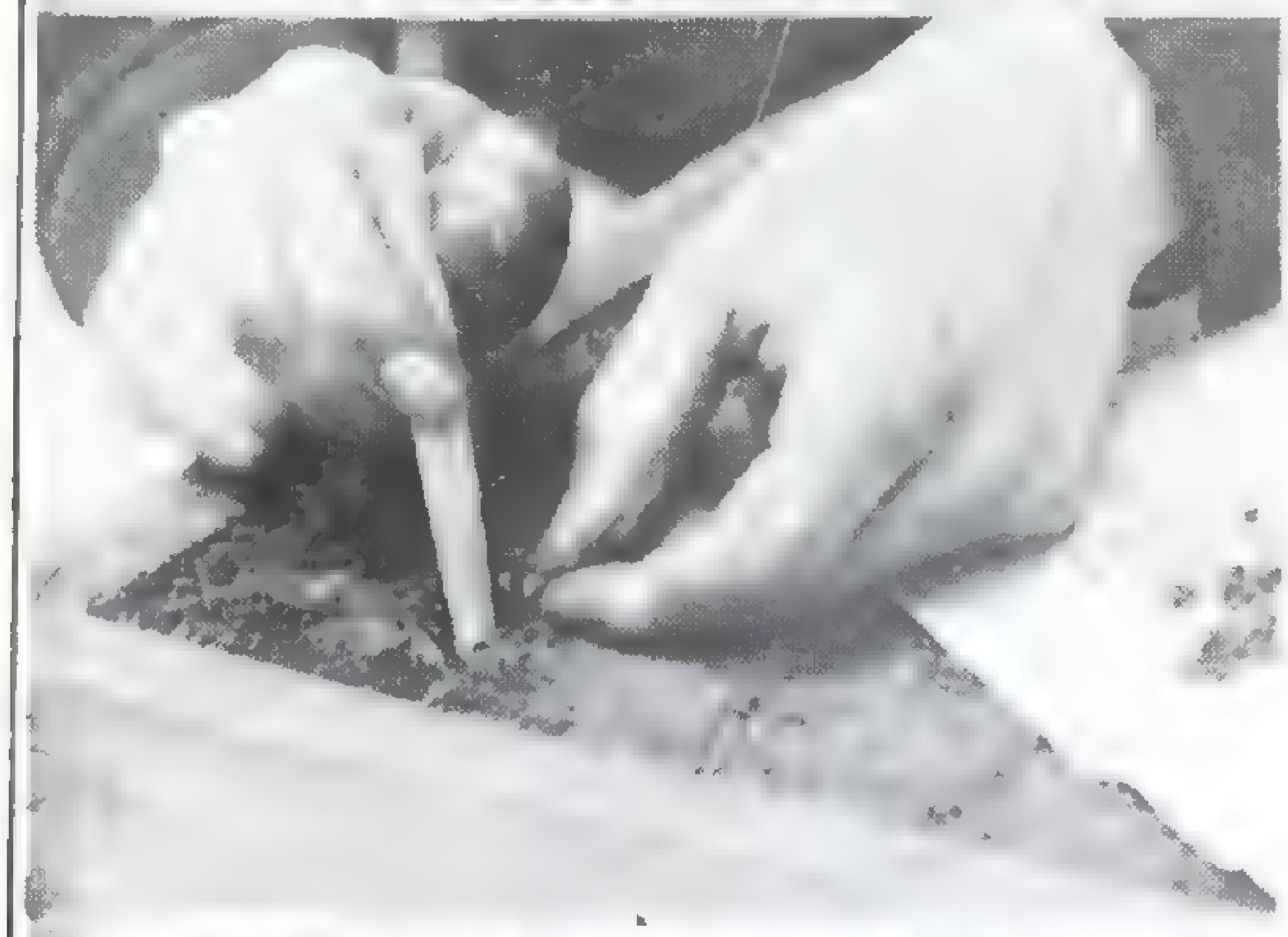
DIBBLING HOLES



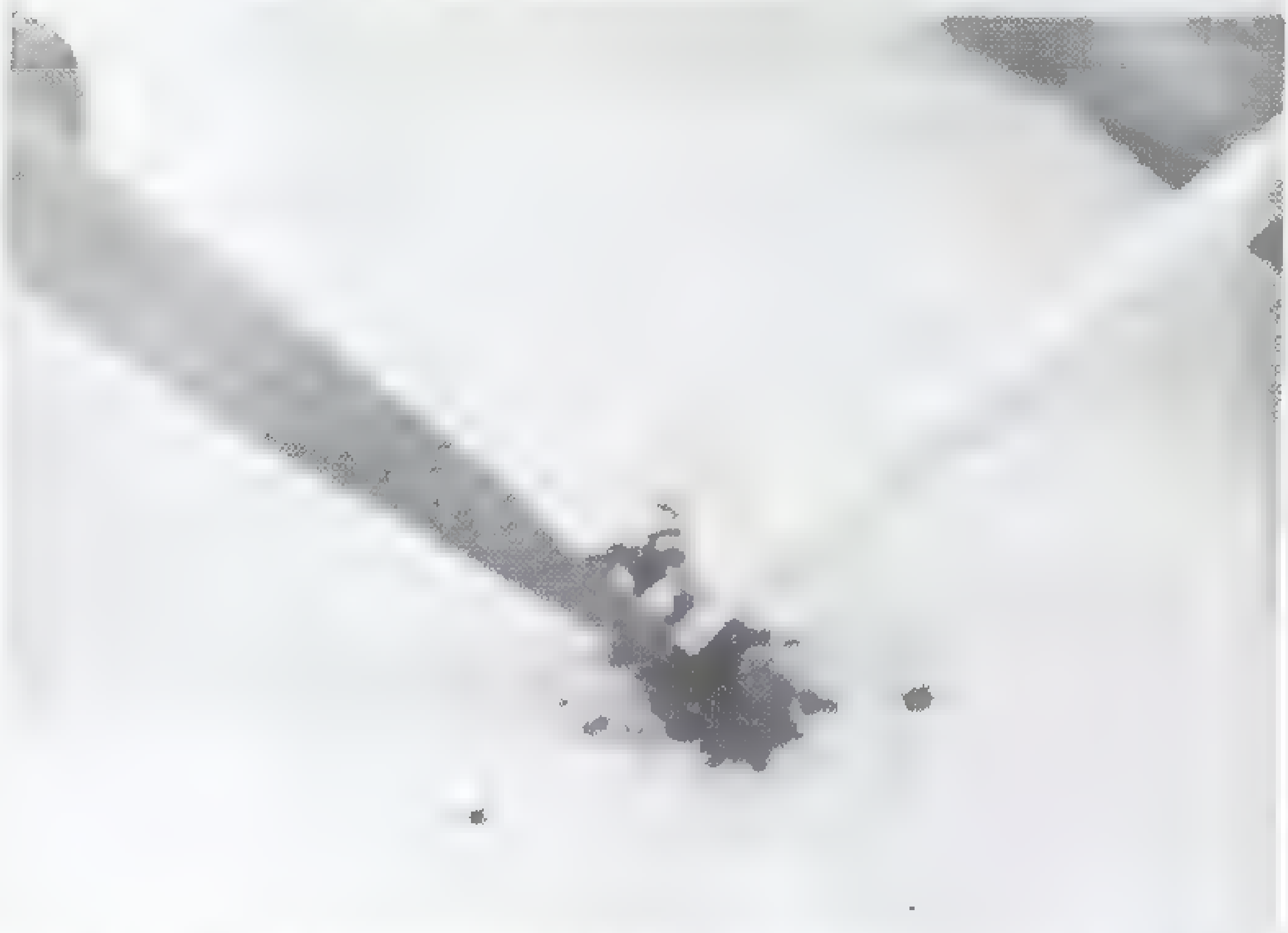
PINCHING ROOT



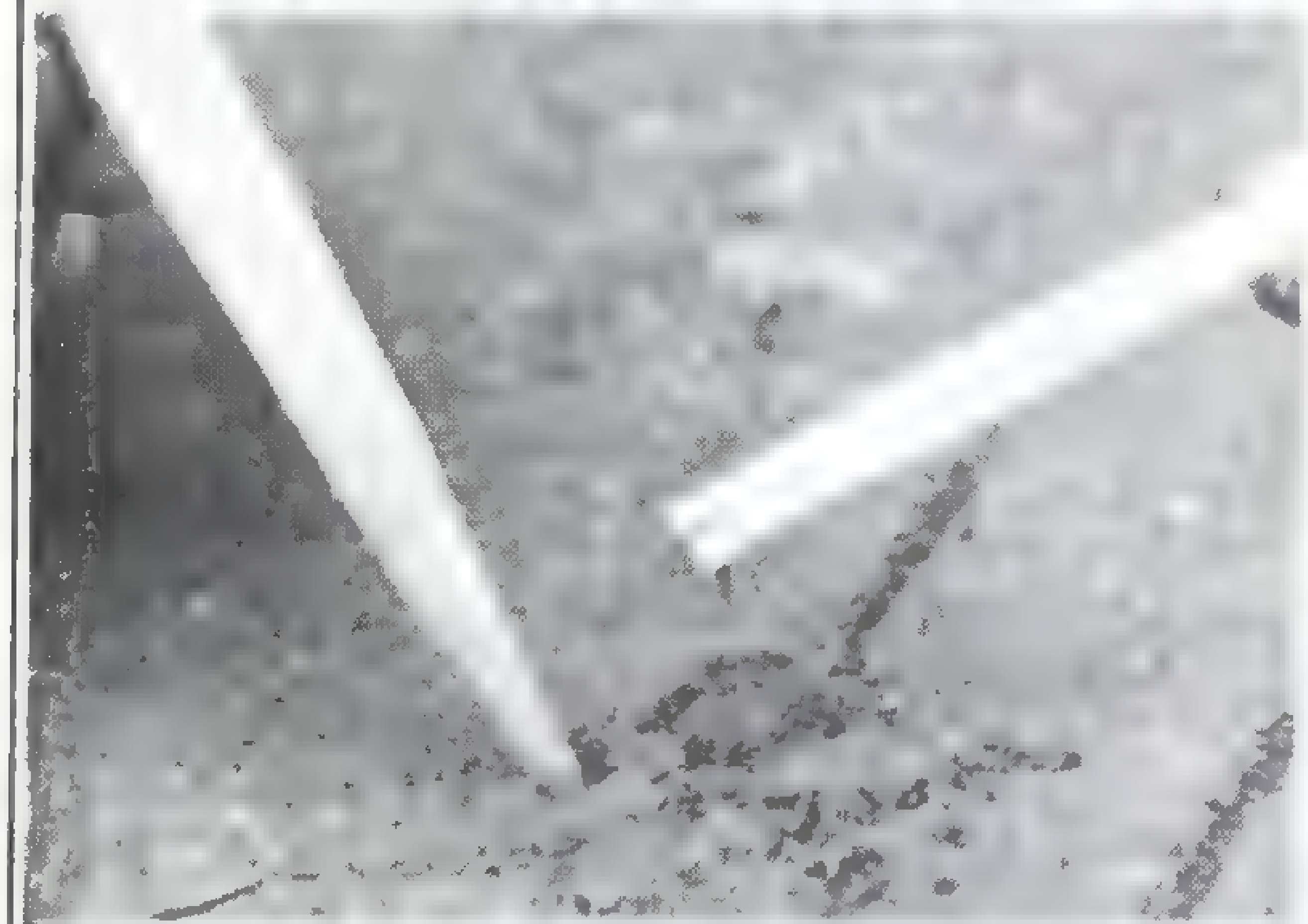
PLANTING SEEDLING



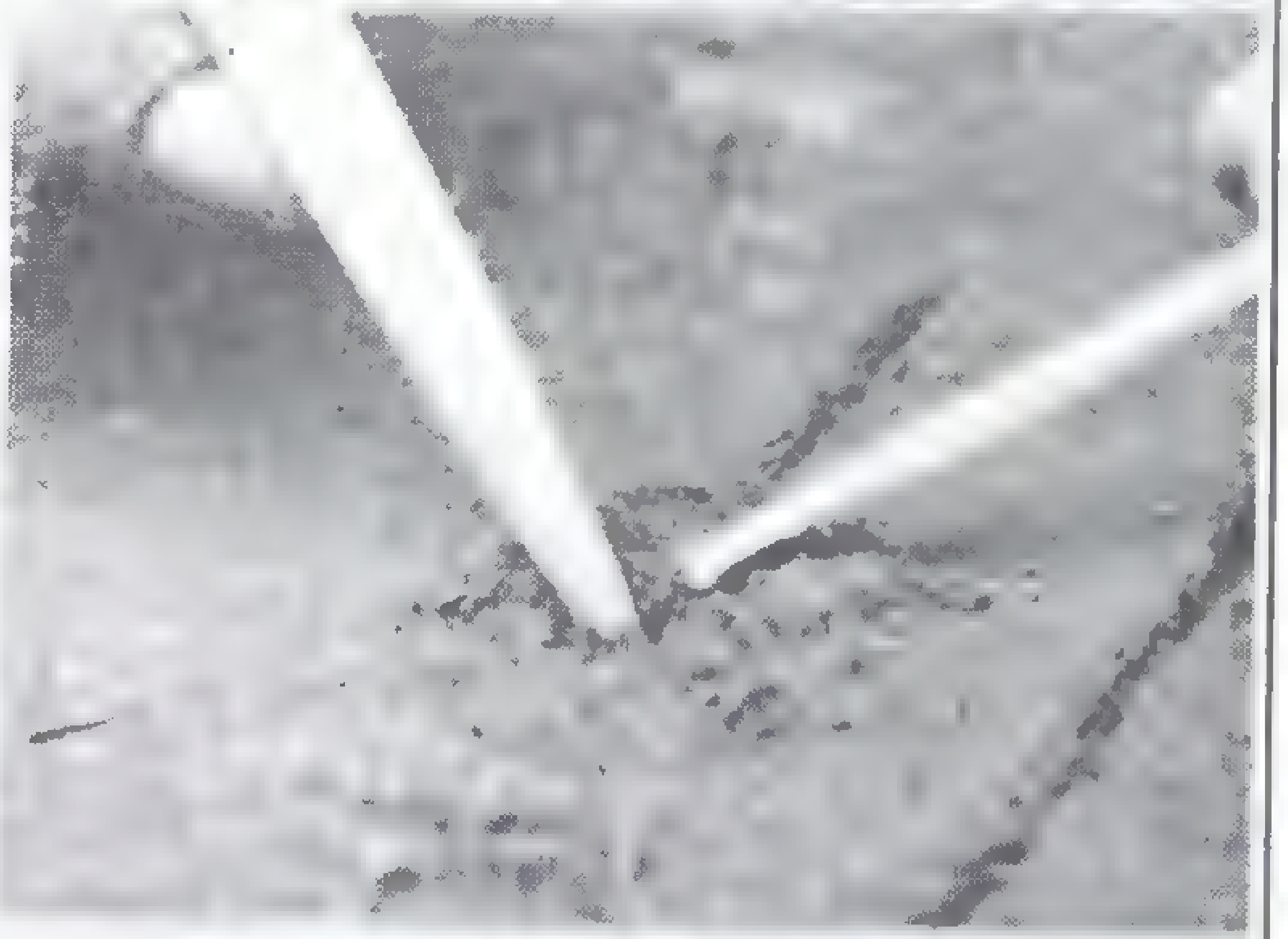
FIRMING SOIL



LIFTING TINY SEEDLING



PLANTING SEEDLING



FIRMING SOIL

TRANSPLANTING OPERATIONS

light soil. It should then be leveled and tamped in the same manner as when the seeds were sown. The surface should be finished with some finely sifted soil and tamped. If this is not done, especially when small seedlings are to be transplanted, the small lumps of soil will cause much annoyance. If the soil is very dry it should be watered before transplanting the seedlings and then set aside. A box of damp soil that needs no water is to be preferred to one that has been watered an hour previous. Soggy soil clings to the dibber and the fingers.

To remove the seedlings from the seed box, with the right hand insert a stick or plant label beneath the roots and gently raise a bunch of seedlings, at the same time grasping them with the left hand. Do not take all of the seedlings from the box at one time as they dry out very rapidly. Lay them on a piece of paper and bring them to the box of soil. Mark the rows on the surface of the soil with a straight-edged stick. Space the rows in the flat from one and a half to two or three inches apart, depending upon the size of the plants. Also space the plants the same distance in the rows. The size of the seedlings soon after germinating serves as a fair indication of the distance apart to transplant them. With the dibber make a hole in the soil deep enough to receive the roots without crowding. Slightly turn the dibber back and forth as it is withdrawn from the hole to prevent any soil from rolling back. If the seedlings have unusually long taproots, pinch them back halfway. This will do no harm and will cause the plantlet to send out lateral roots. After the seedling is placed in the hole the dibber is again thrust into the soil near the seedling and the soil firmly pushed against the roots. If an air pocket is left at the bottom of the hole the roots cannot come in contact with the soil. Seedlings should be transplanted to about the same depth as they were in the seed box. However, when they are very spindly and have a tendency to shoot up, they should be planted deeper in the hole. There are some kinds of seedlings, the delphinium being an example, in which the heart of the plant is quite low. In transplanting such seedlings one must be careful not to cover the center of the plant, lest it might rot. Again there are large seedlings that produce robust plants (lupines, castor beans, etc.). These should be immediately set into two- or two and one-half-inch pots.

In order that minute seedlings may safely be transferred to flats of soil a small wooden fork made from a plant label or any piece of thin wood is used. With this fork the seedling is lifted and if it clings to some of the others they are separated with the dibber. The dibber for transplanting tiny seedlings should have more of a point than the ordinary dibber. A collection of dibbers of various thicknesses for different sizes of seedlings will prove most convenient. Holding the wooden fork with the left hand, lift the seedling to the seed box, barely make a depression in the soil, then lower the seedling and firm a little soil around it with the dibber. Tiny seedlings must be carefully watered until they produce enough roots to hold them in place. A watering pot with a fine-spray nozzle is essential to such work. After the flat is filled with plants it should be watered and placed in the frame or window. If the sun is shining brightly, shade the plants with paper the first and second days. Seedlings that have been crushed or broken in handling will wilt and die.

If the seedlings are transplanted to a pot instead of a box, and this can be done if only a few dozen of a kind are wanted, the surface of the soil should not be more than one-fourth inch below the top of the pot. Larger seedlings may be set deeper. Seedlings planted in flats will not dry out as rapidly as those in pots, and more can be grown in a given space if planted in rows in flats. If it is intended to leave the seedlings in the flats until time for planting directly into the garden, more space should be allowed in the flats when they are transplanted from the seed-box.

Seedlings that are to be transplanted to pots should be carefully lifted with a spoon or plant label and should have as much soil adhering to the roots as possible. The plant is held in the center of the pot. Then the soil is added and firmed about the seedling. Just when to water the seedlings after repotting will depend upon weather and soil conditions. If the day is cloudy and the potting soil is moist a day may elapse before watering. If, however, the soil is dry, but this condition could be improved when the soil is mixed, and the day clear and warm, the seedlings will have to be watered soon after potting. If very dry, the pots should be soaked before using, otherwise they will absorb much of the soil moisture. When a plant is reset the root system is disturbed, and if the potting soil is moderately moist new roots will form more quickly than if the soil is quite wet. It is always a good policy to keep newly potted plants a little on the "dry side" until root development is again active. Wilting may be prevented during this period by lightly spraying the foliage and shading the plants.

When warm weather has arrived and the flower beds are prepared the plants may be taken out of the pots and set in their place. Plants whose roots have become matted due to the length of time in the pots should have the bottom roots loosened before planting. This will break up the distinct ball the roots have been forming and will cause them to strike out in all directions and take hold of the soil in the flower bed. As soon as possible after all the plants have been set in beds they should receive a good watering. The same precautions used when transplanting from boxes to pots must be taken against wilting when planting the seedlings in the flower beds. Cloudy weather is ideal for planting flowers outside. Late afternoon and evening are better than the morning for transplanting, as the plants can revive during the night. Transplanting should not be done on extremely hot and windy days. A good gardener will find ways and means to overcome the difficulties that will at times confront him.

P. A. K.

II. VEGETATIVE PROPAGATION

Many garden plants are best propagated by vegetative methods, not by seed. Some reproduce naturally by offshoots such as runners, suckers, bulbs, roots, rhizomes and leaves, whereas others are increased artificially by various types of cuttings, layering and grafting. These methods of propagation are absolutely necessary in order to perpetuate the desirable characteristics of numerous hybrid specimens created by plant breeders. For instance, all the fine varieties of iris, peonies, roses, dahlias and gladiolus do not come true to color, size or shape when raised from seed, but if propagated by division of the clump, or by root and stem cuttings, all of the varietal characters are retained in the offspring. When plants have been so highly specialized by hybridization that they produce no seed, vegetative methods of increase must be adopted. The seedless grape and orange are common examples of this specialization, as well as many ornamentals which are infertile due to excessive doubleness of the flowers. Some plants are so difficult to raise from seed that amateurs can hardly devote the time and effort essential in their culture. Thus for various reasons many ornamental and economic plants are propagated by one of several methods indicated in the following outline, the choice of method being determined by the type of plant, the results desired, and the equipment available.

- Stem
  1. Cuttings
     A. Soft-wood
     B. Half-ripened wood
     C. Hard or dormant wood
  2. Rhizomes
  3. Runners
  4. Offsets
  5. Layers
  6. Bulbs, bulbels, bulblets, scales
  7. Corms, cormels
  8. Tubers
- Root
  1. Cuttings
  2. Suckers
  3. Tuberous roots
- Leaf
  1. Viviparous leaves
  2. Leaf without petiole
  3. Leaf with veins severed
  4. Leaf divided into sections
  5. Leaf with petiole
  6. Leaf-bud cutting
- Entire Plant
  - Division of clump or crown

Of course it is first necessary to decide how a certain plant should be propagated, vegetatively or by seed. Such information can often be obtained by studying the plant in question, but mere observation is not always reliable as the visible characters do not necessarily reveal the genetic make-up of the individual. In other words, a striking variety of gladiolus may develop a fine lot of seed pods, but it is quite likely that only very few seeds will produce desirable plants. So the presence of seed is often just a detour sign for all except the plant breeder.

As a general rule plant propagation for the amateur may be summarized as follows: (1) seed only—practically all annuals and biennials, (2) seed and vegetative methods—true species of perennials and some annuals, (3) vegetative methods only—all hybrid varieties of perennials. To this classification there are exceptions, but for the most part vegetative propagation is concerned with the hardy and tender perennials of garden and greenhouse.

1. Propagation by Means of Stems

Cuttings.—A cutting is a piece of root, stem, or leaf which is able to continue growth and establish an entire new individual when detached from the rest of the plant. Propagation by this method is widely practiced commercially because it a quick and economical way to increase stock. Many perennials supposedly do not respond to such treatment, but there is hardly any doubt that cuttings of all plants could be induced to form roots and shoots if provided with the proper conditions.

Success with cuttings depends largely on the methods of handling, the requirements varying with the different kinds of plants. Usually the cuttings do well if exposed to conditions favorable to the growth of the parent plant, but in certain cases special treatment is necessary, and even with the best of care, failures are apt to occur. The chances of error can be materially reduced if the right kind of plant material and equipment are used.

Plants.—Always select healthy, vigorous plants as stock for cuttings. Those blighted with disease or infested with insects should be avoided unless they are thoroughly cleansed of these parasites before using. Otherwise one is just courting trouble.

Rooting medium.—Soil, peat sphagnum moss, sand, and water may be used in rooting cuttings. For outdoor work a light sandy loam gives fine results. Peat and sphagnum moss are used to advantage with certain types of cuttings and for layering. Rooting in water is also possible with some plants, but in the majority of cases clean sharp sand of moderately coarse texture is the best material to use. It permits good drainage and aeration which are beneficial to root formation.

Propagating-pots, cases, benches.—When only a few cuttings are to be rooted, an eight-inch bulb pan equipped with a small pot for irrigation purposes makes a convenient arrangement. A handful of broken crockery is placed in the bottom of the pan for drainage and the sand filled in around the small pot which has the hole at the base tightly corked. Water gradually seeps out of the small porous clay pot and keeps the sand uniformly moist. This is a very handy outfit for home use. A glass bell-jar placed over the cuttings will protect them from the harmful dry atmosphere present in most dwelling houses.

A shallow box or flat of sand, with a pane of glass on each side and on top to conserve the moisture, makes a fine propagating-case. An aquarium containing several inches of sand and fitted with a glass cover will serve the same purpose. With such equipment one can carry on an interesting form of gardening in the home during the winter months. The propagating-case or pot should be placed where the cuttings can have the benefit of sunlight. Glass-enclosed cases or jars heat up quickly when exposed to direct sunlight, so it is necessary at times to prop open the lids or remove the jars to provide adequate ventilation. Slight bottom-heat from a steam or hot water radiator will stimulate root action. In the greenhouse, propagating benches are used for cuttings. Steam or hot-water pipes are usually placed under the benches to control the temperature of the sand. Some cuttings are almost impossible to root without this bottom-heat.

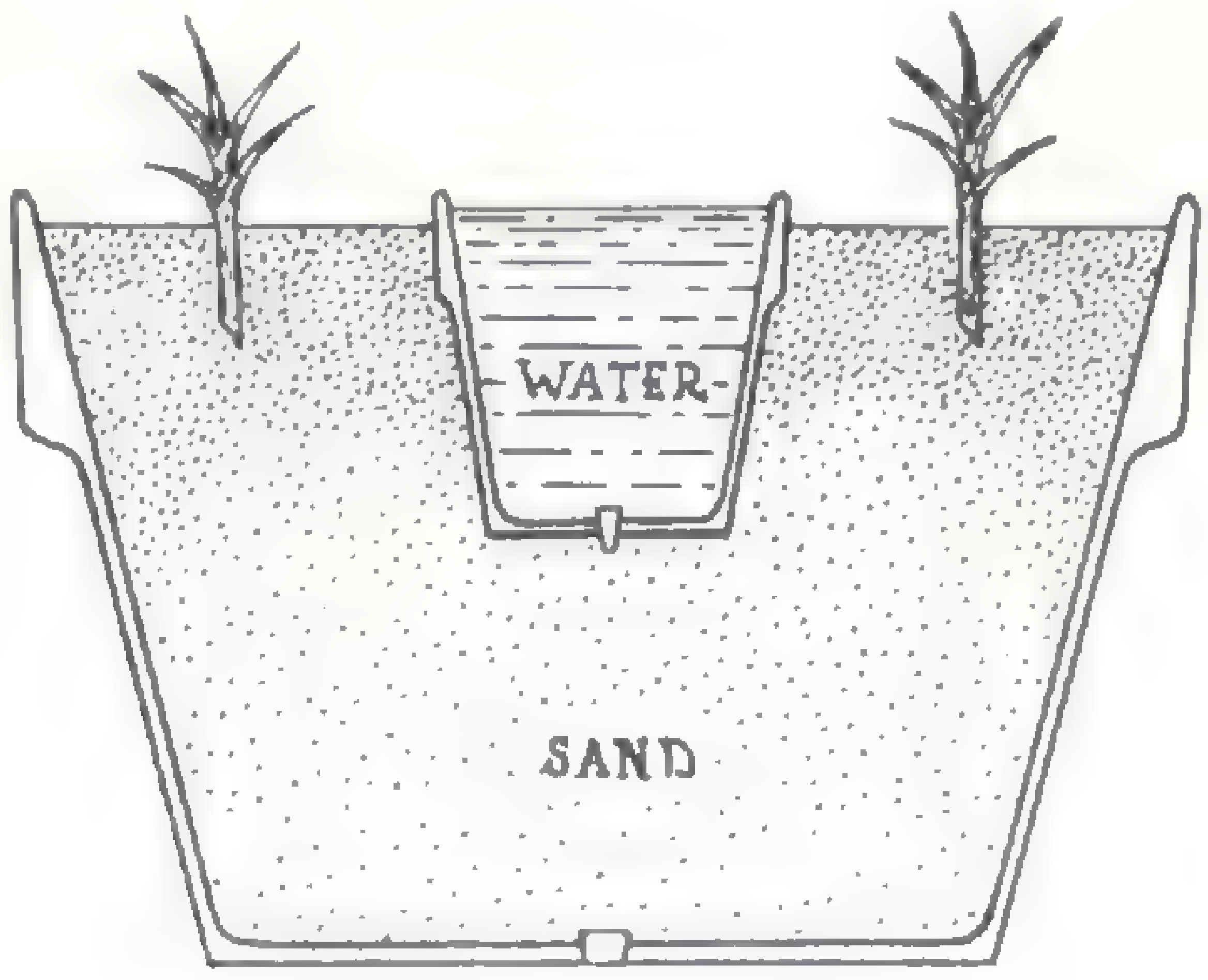


Fig. 1. Propagating-pot.*

When a confined moist atmosphere is needed for rooting, a box or frame is placed on top of the bench. Certain kinds of cuttings will not root unless given the protection of a frame where drafts can be avoided as well as variations in moisture and temperature. Bell-jars or any wide-mouthed glass container serve the same purpose on a smaller scale.

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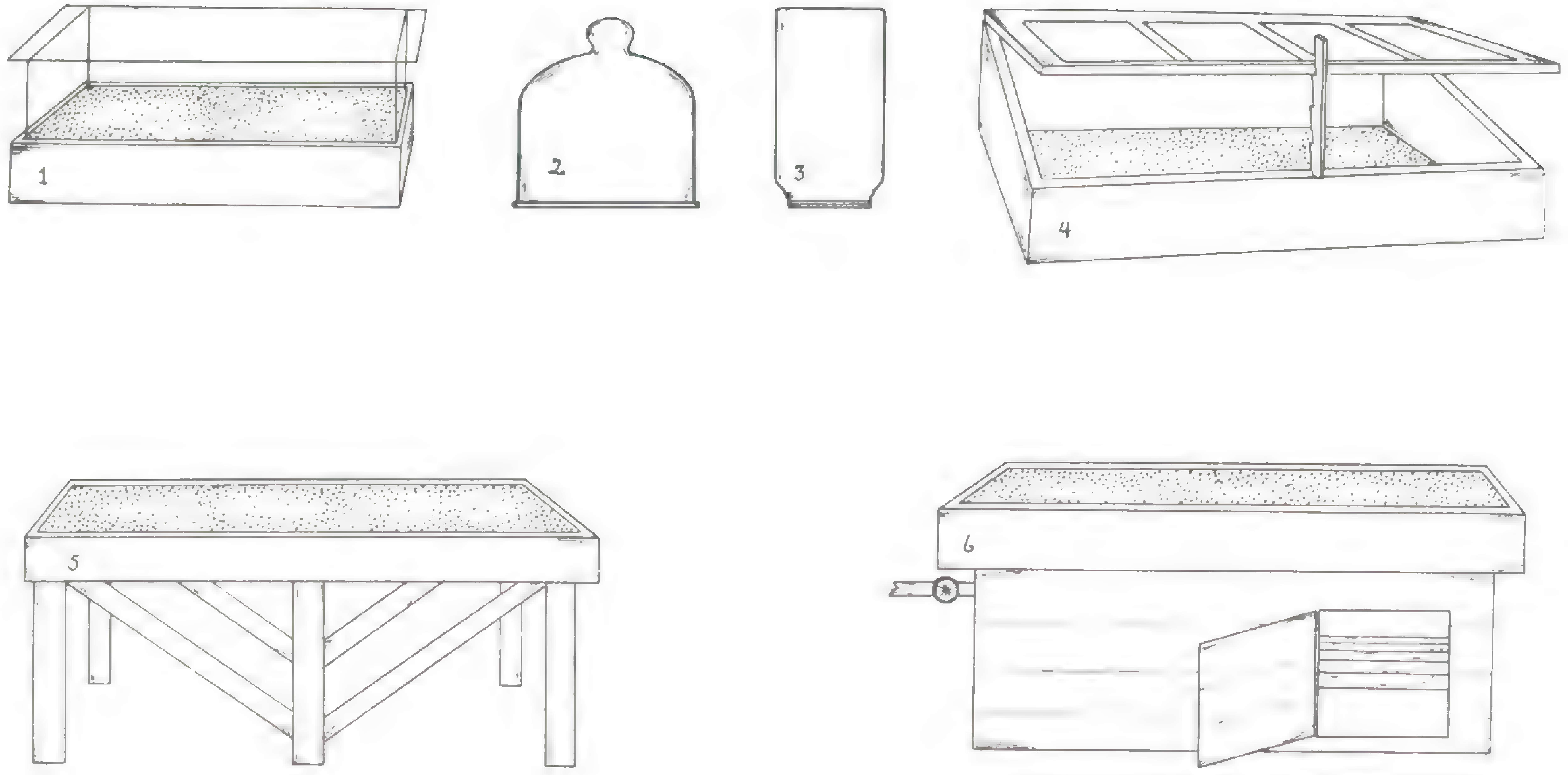
*Reproduced from D. C. Fairburn's *Plant Propagation for the Garden*. Doubleday, Doran & Co. 1936.



(From Fairburn's *Plant Propagation*)

Fig. 2. **EQUIPMENT FOR VEGETATIVE PROPAGATION**

1. Propagating box with glass enclosure. 2. Glass bell jar. 3. Fruit jar. 4. Propagating case (Wardian case). 5. Propagating bench without bottom heat. 6. Propagating bench with bottom heat supplied by steam or hot water.

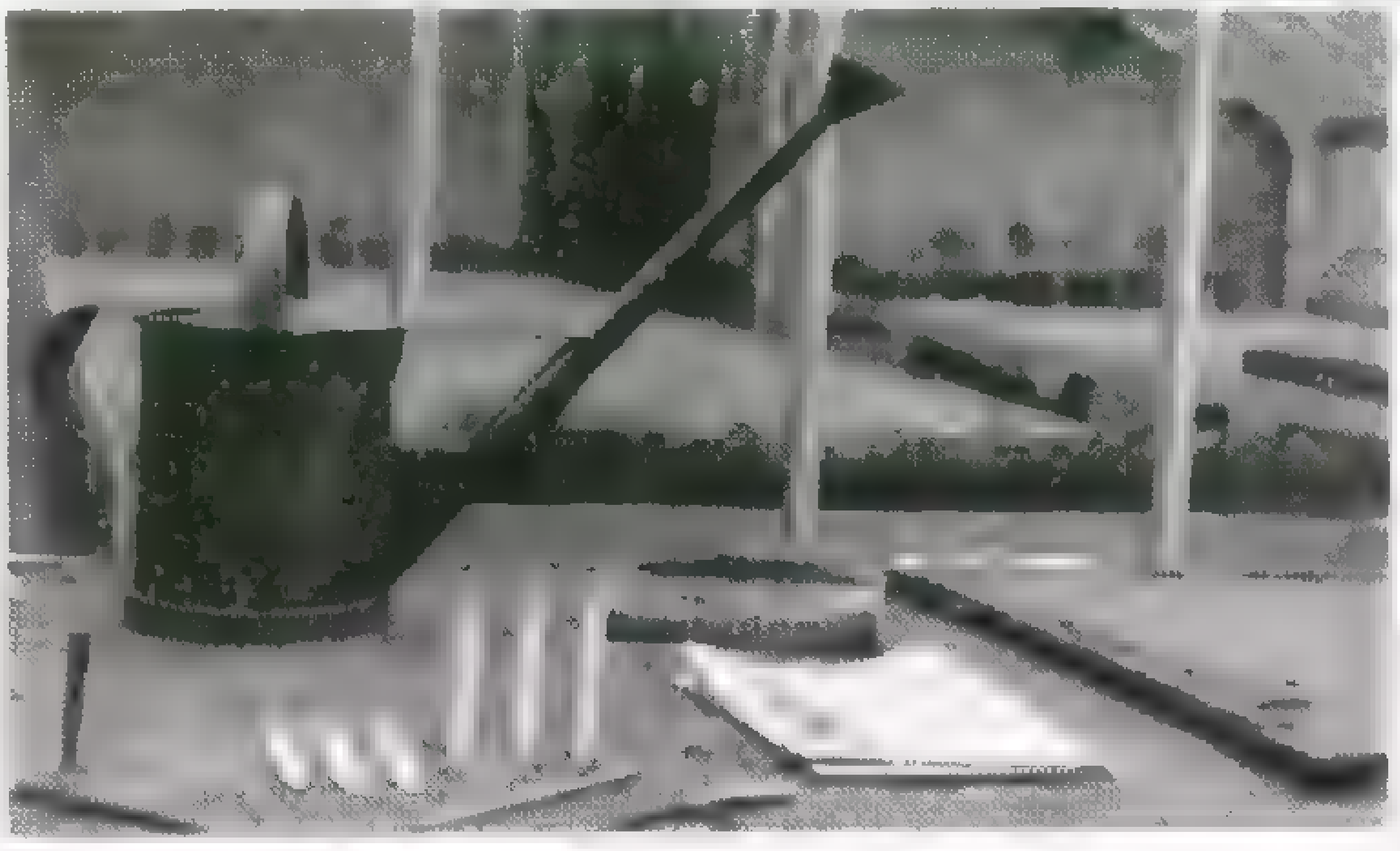
Cuttings of herbaceous perennials and woody plants are easily rooted outdoors if placed in a sash frame containing a well-drained, light, sandy soil. The frames require shading with lath or something to keep out the direct rays of the sun and prevent excessive evaporation during the summer.

Temperature, moisture, light.—The proper rooting temperature for different kinds of cuttings varies from 50° to 80° F. or over. For the majority of plants, however, about 65° to 70° F. is ideal. Root growth should accompany or precede top growth, and for this reason bottom-heat is applied to keep the sand 5 to 10 degrees warmer than the air. In frames outdoors this extra heat may be obtained from the soil or by several inches of fermenting manure placed under the substratum. The latest and best source of heat is electricity. Cables are stretched under the sand and a constant temperature maintained by thermostatic control.

Humidity is a very important factor in plant propagation and must be regulated to suit the kind of cuttings being handled. For example, cuttings of cacti and other succulents require a fairly dry environment. Too much moisture in the air or sand causes them to rot in a hurry. On the other hand, cuttings of many large-leaved conservatory plants demand the close humid atmosphere of a "Wardian Case" to root. If kept too dry, they collapse. For most of the common garden and greenhouse stock, moderately moist conditions are recommended. The sand should never be soggy nor dry. Sprinkle the foliage occasionally to keep the leaves firm.

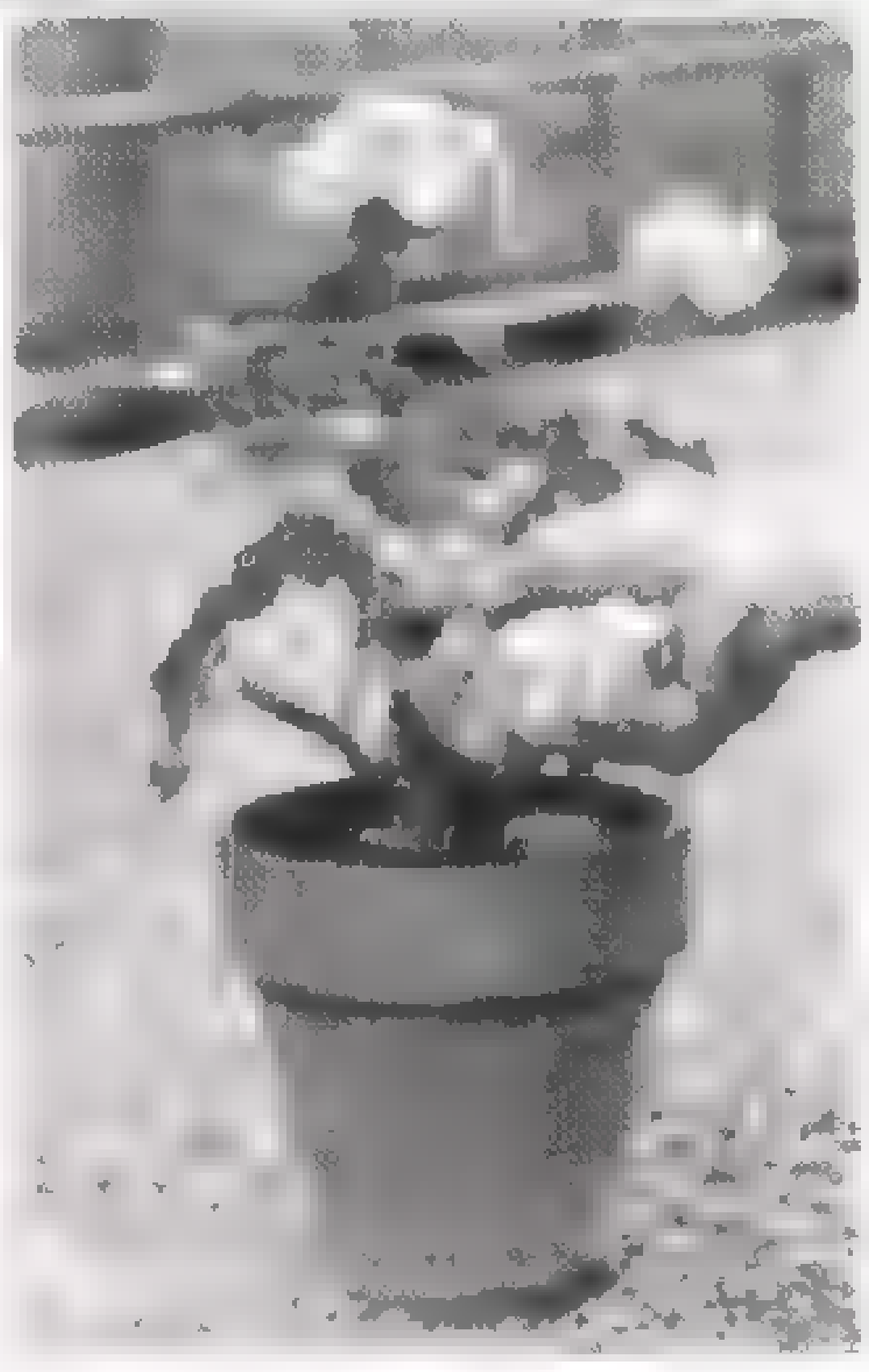
When cuttings are first placed in the sand, they should be shaded from strong sunlight to avoid wilting, but as roots begin to form, more light can be admitted until finally they have established enough feeding roots to stand full sunlight. Keeping the cuttings in a shady place after the roots are well developed is a mistake. Without sufficient light, photosynthesis is retarded, causing the young plants to become spindly and weak. Fresh air is also essential, but avoid drafts.

Tools, accessories.—Other equipment useful in plant propagation is shown in pl. 22, fig. 1. A sharp knife to trim off the cuttings, a tamping block to press down the sand, a straight-edge to mark off the rows if benches or cases are used, a dibble to make holes in the sand for the cuttings, wooden labels, a soft-lead pencil,

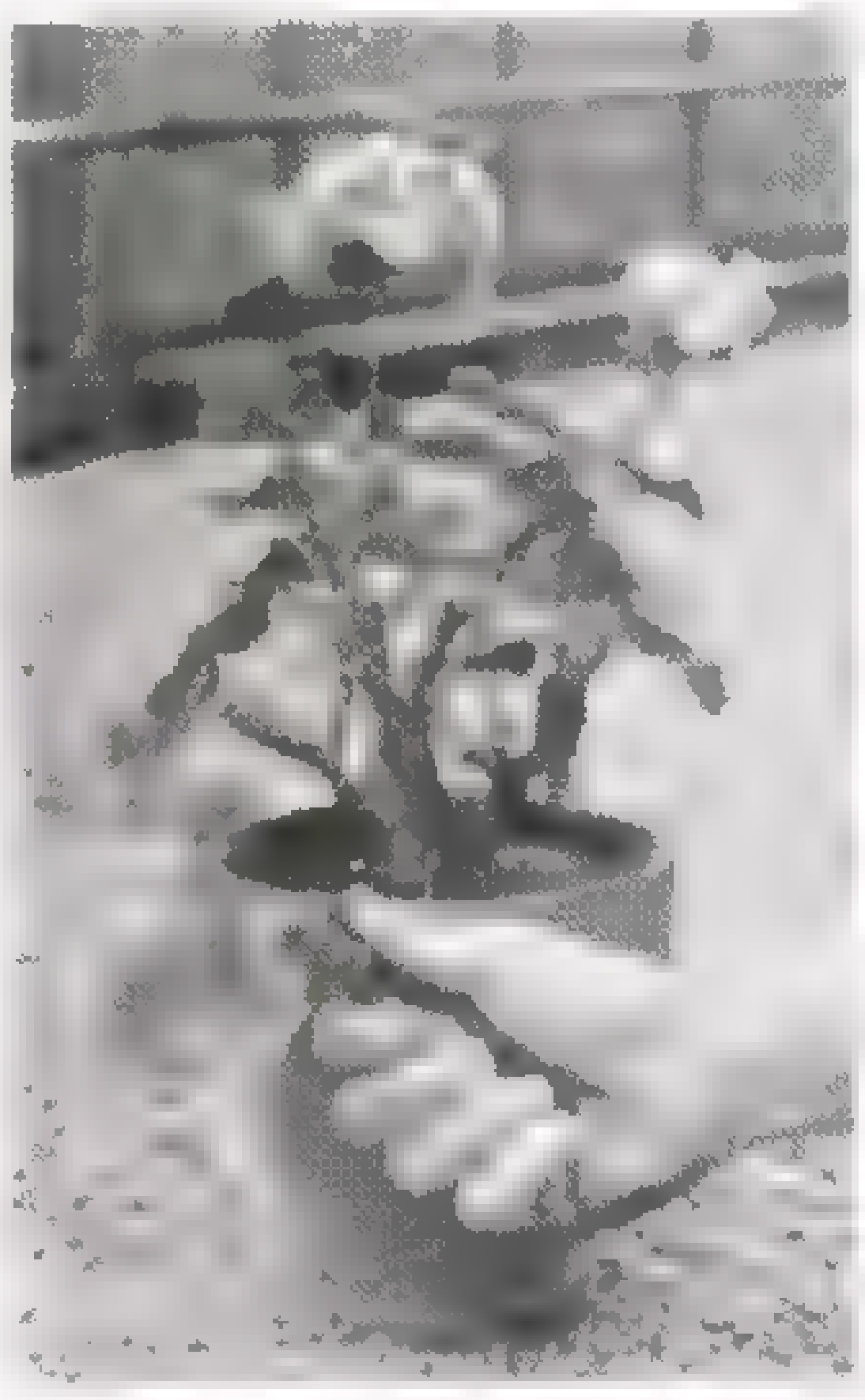


1. USEFUL EQUIPMENT FOR PROPAGATION

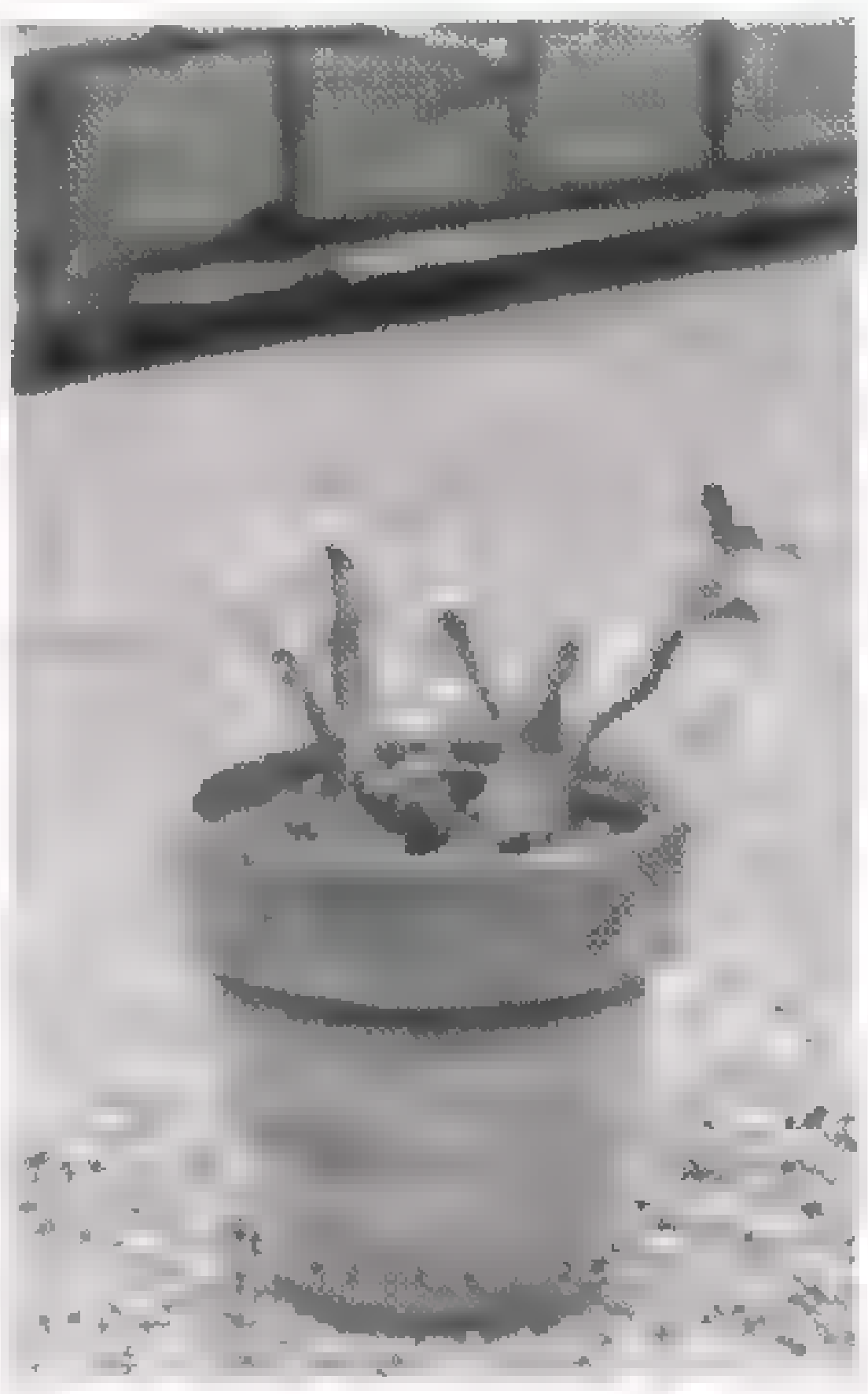
2. STOCK PLANT



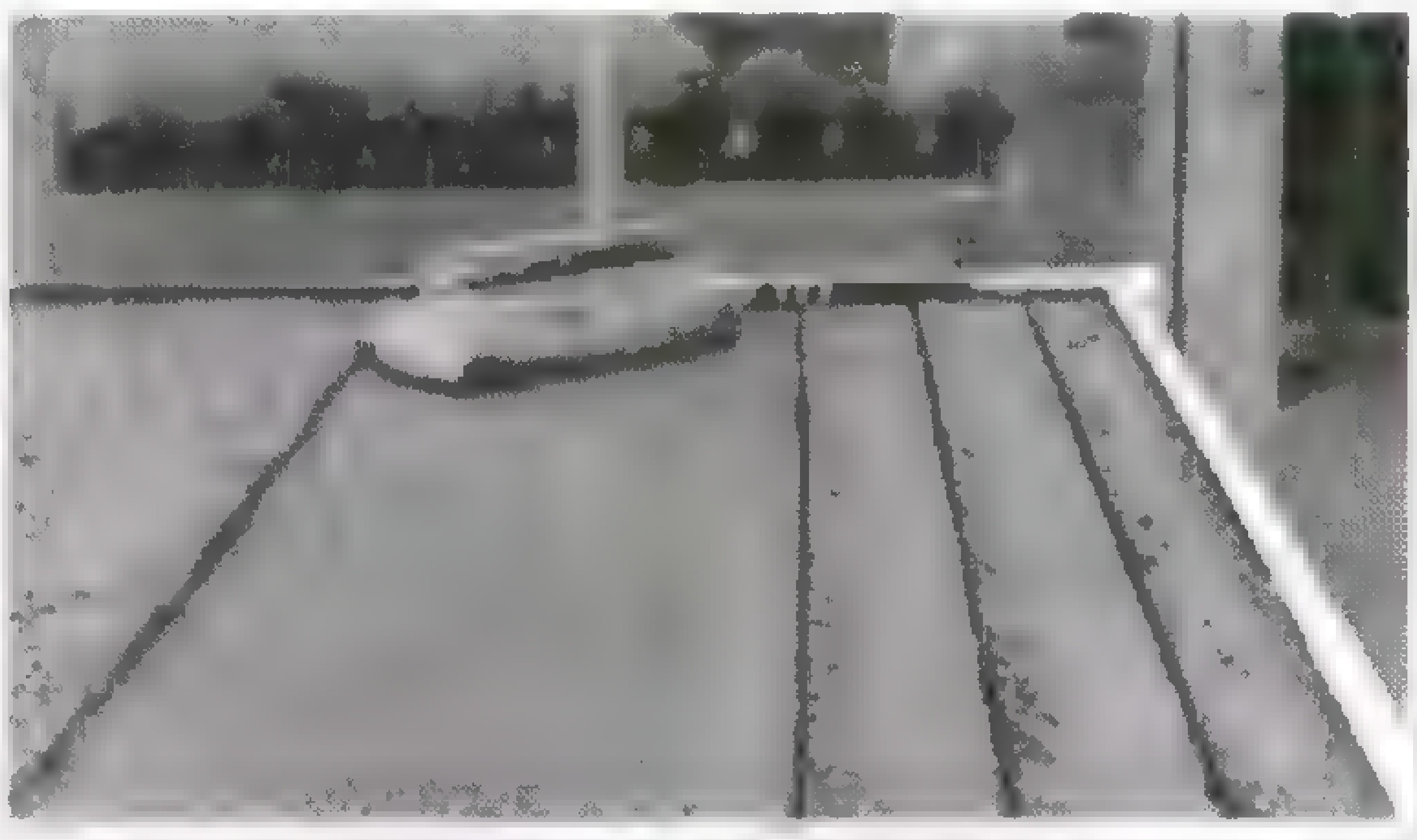
3. TAKING THE CUTTING



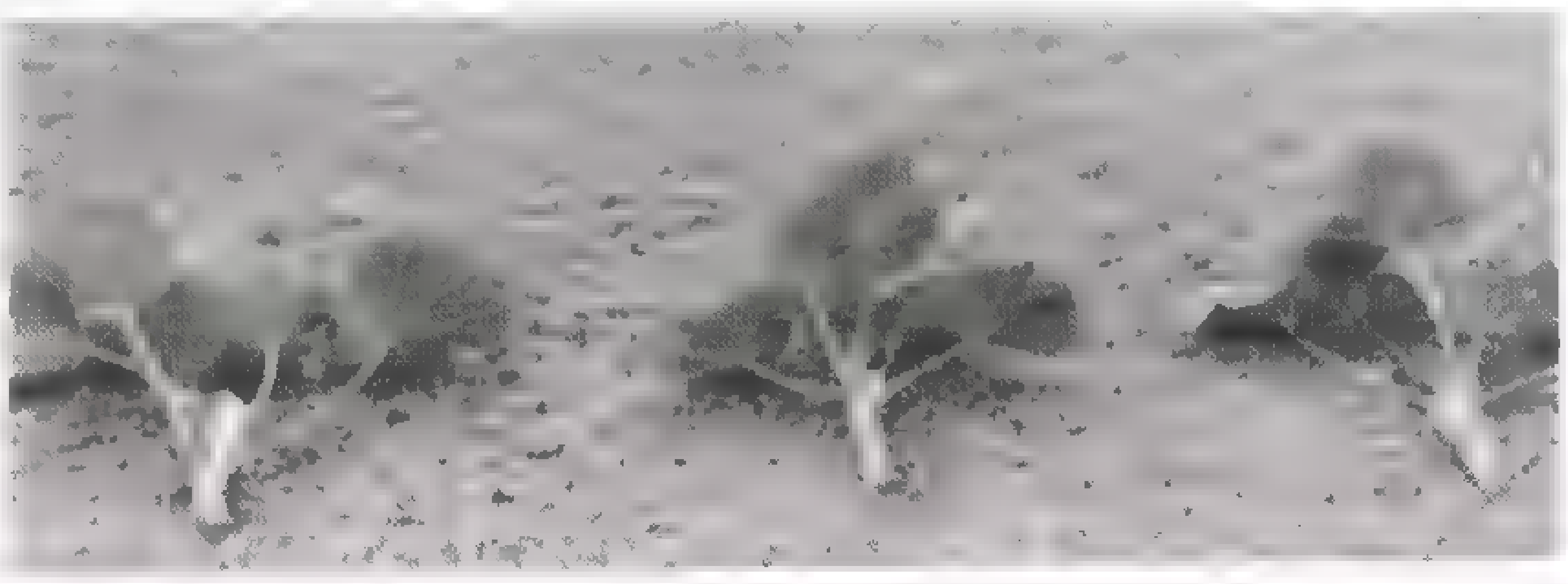
4. CUTTING REMOVED



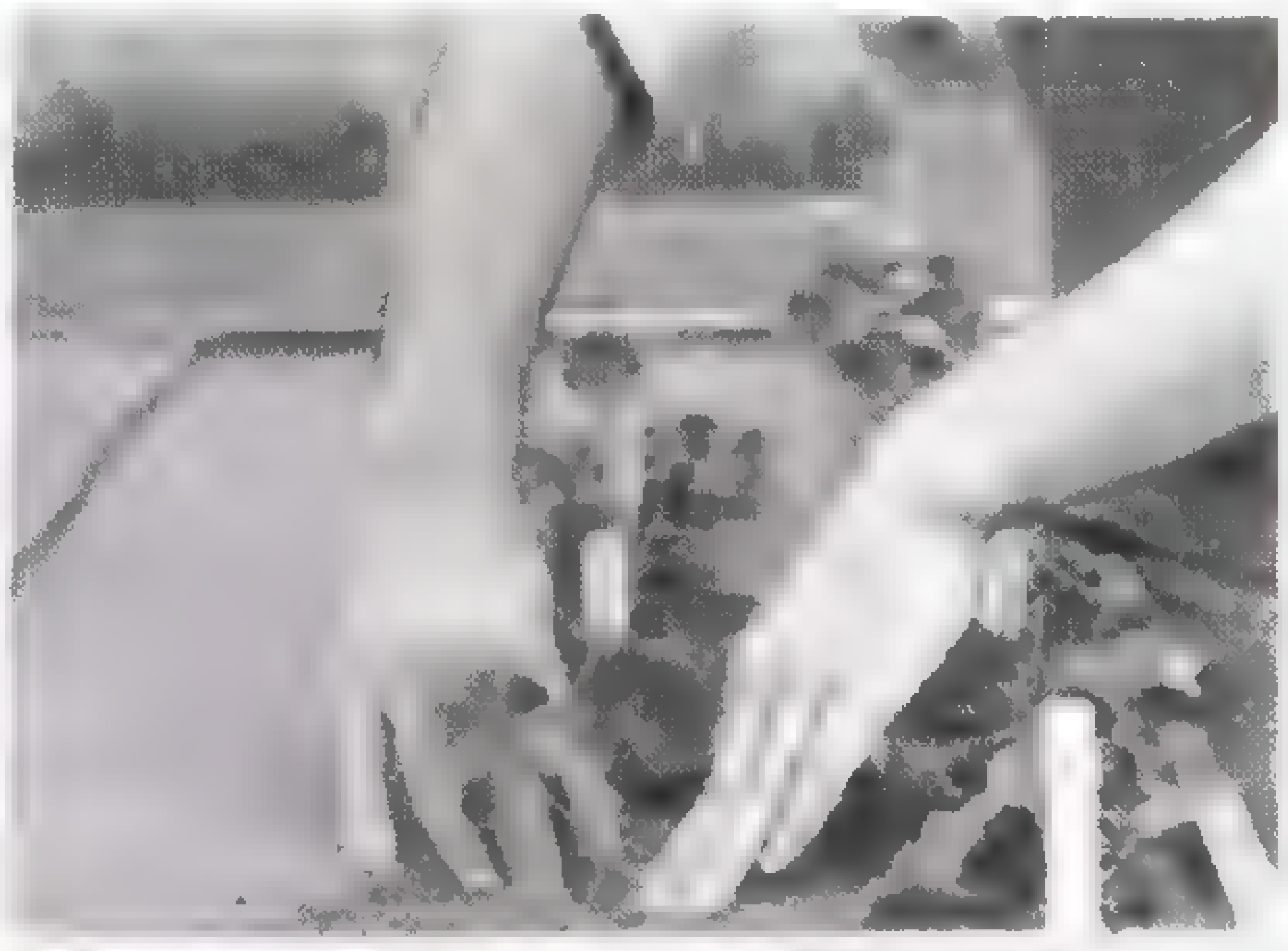
5. STOCK PLANT PRUNED



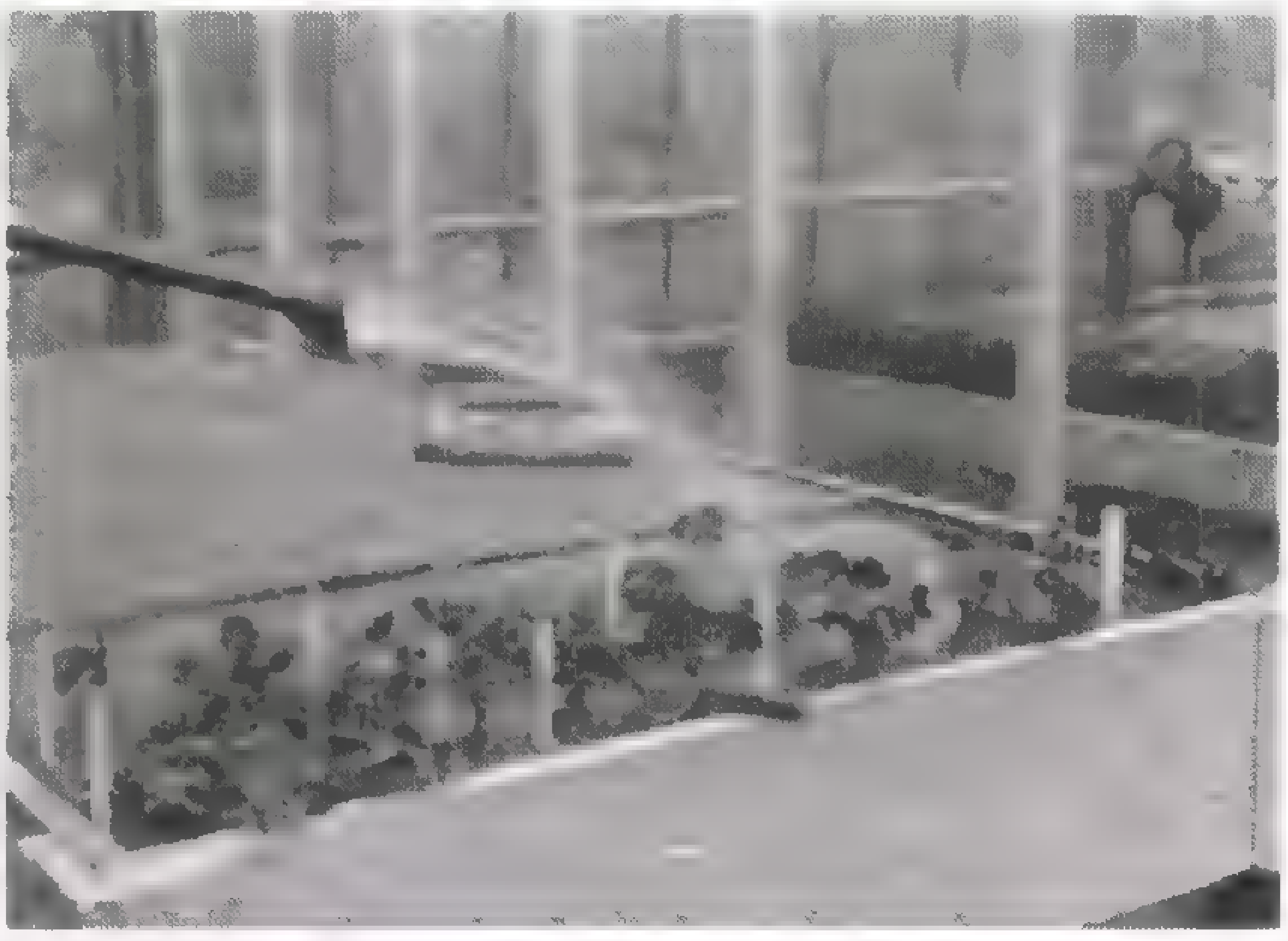
6. SAND TAMPED, ROWS MARKED OFF



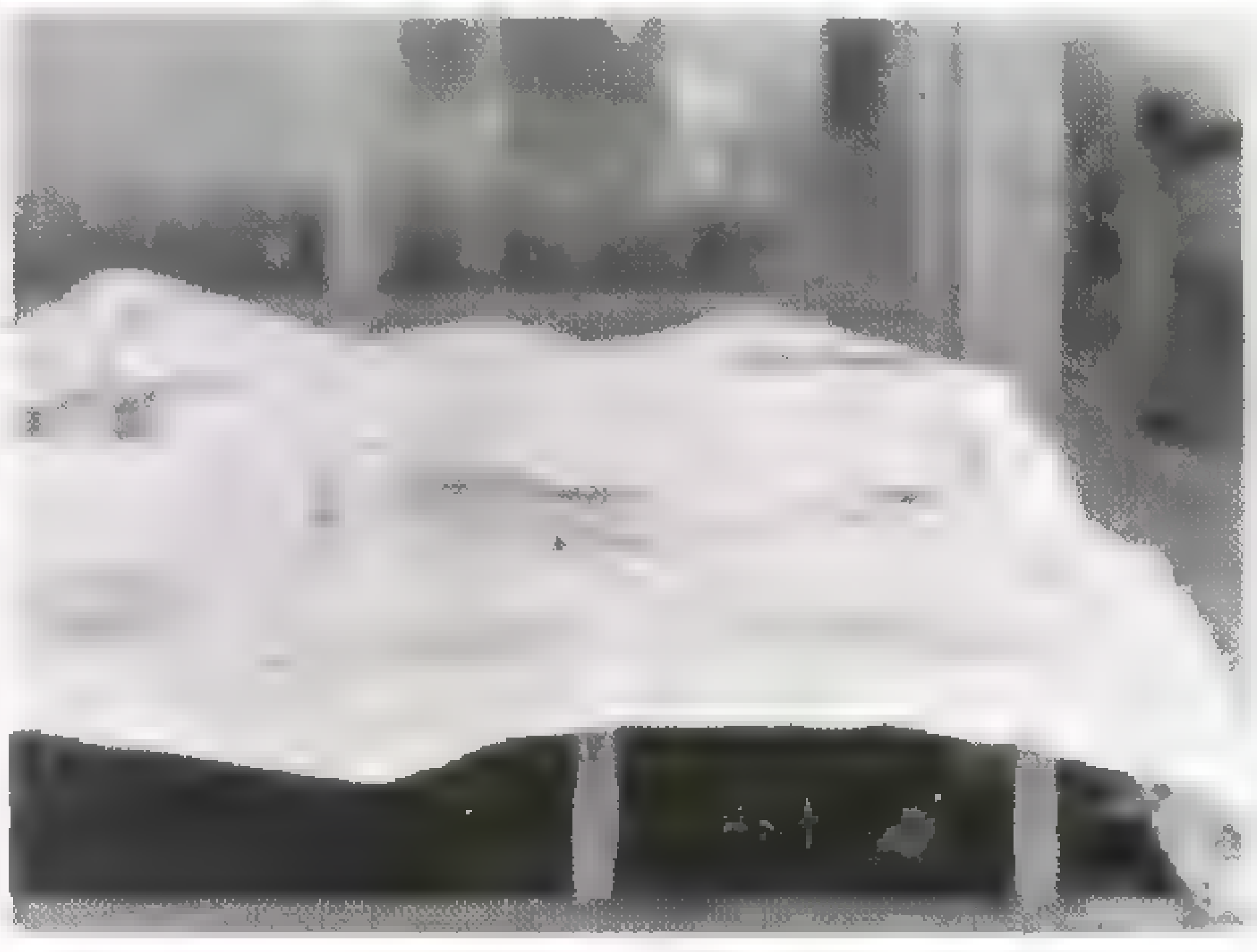
7. CUTTINGS TRIMMED, READY TO GO IN SAND



8. CUTTING FIRMED IN SAND

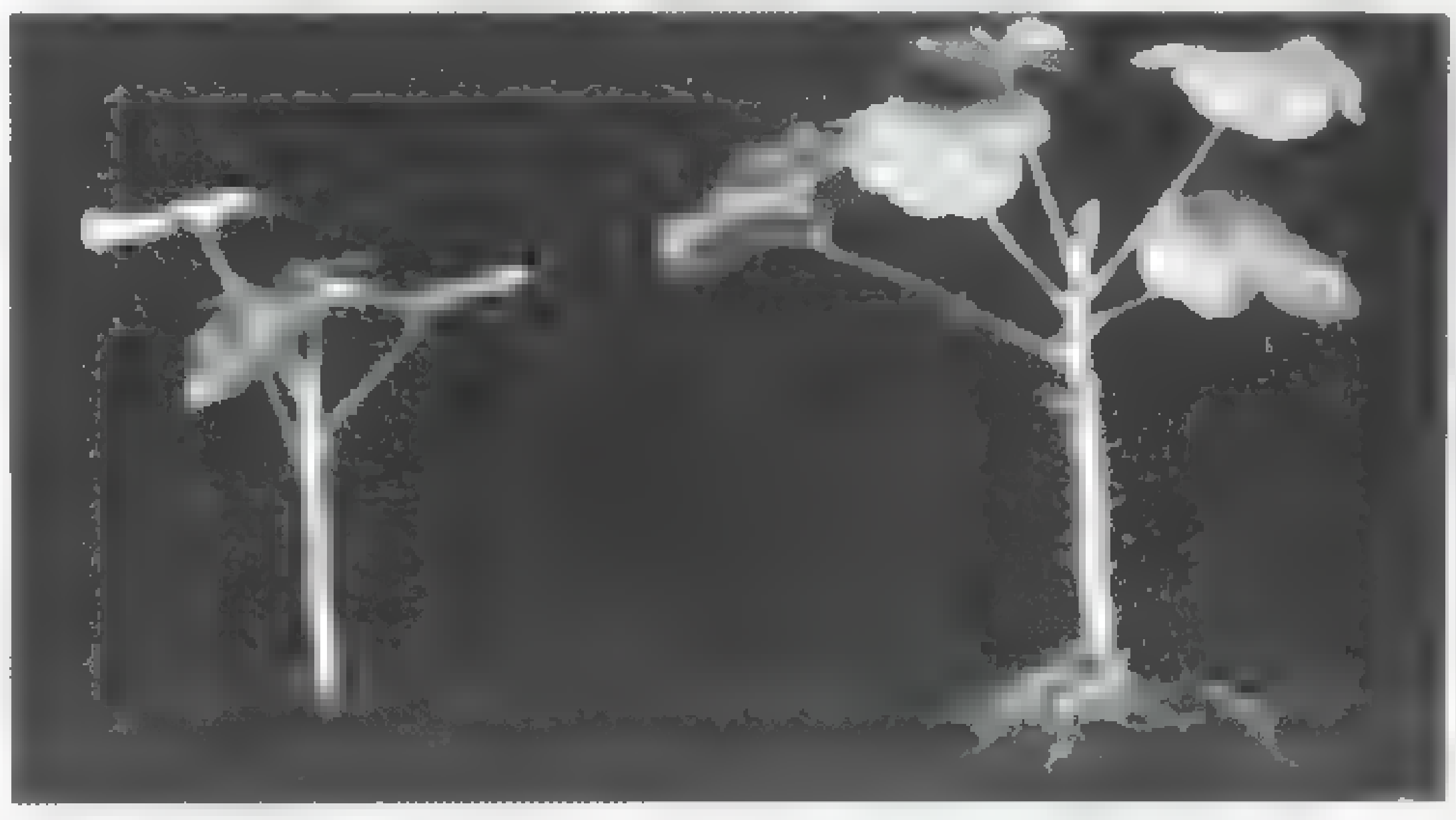


9. CUTTINGS SHOULD BE THOROUGHLY WATERED



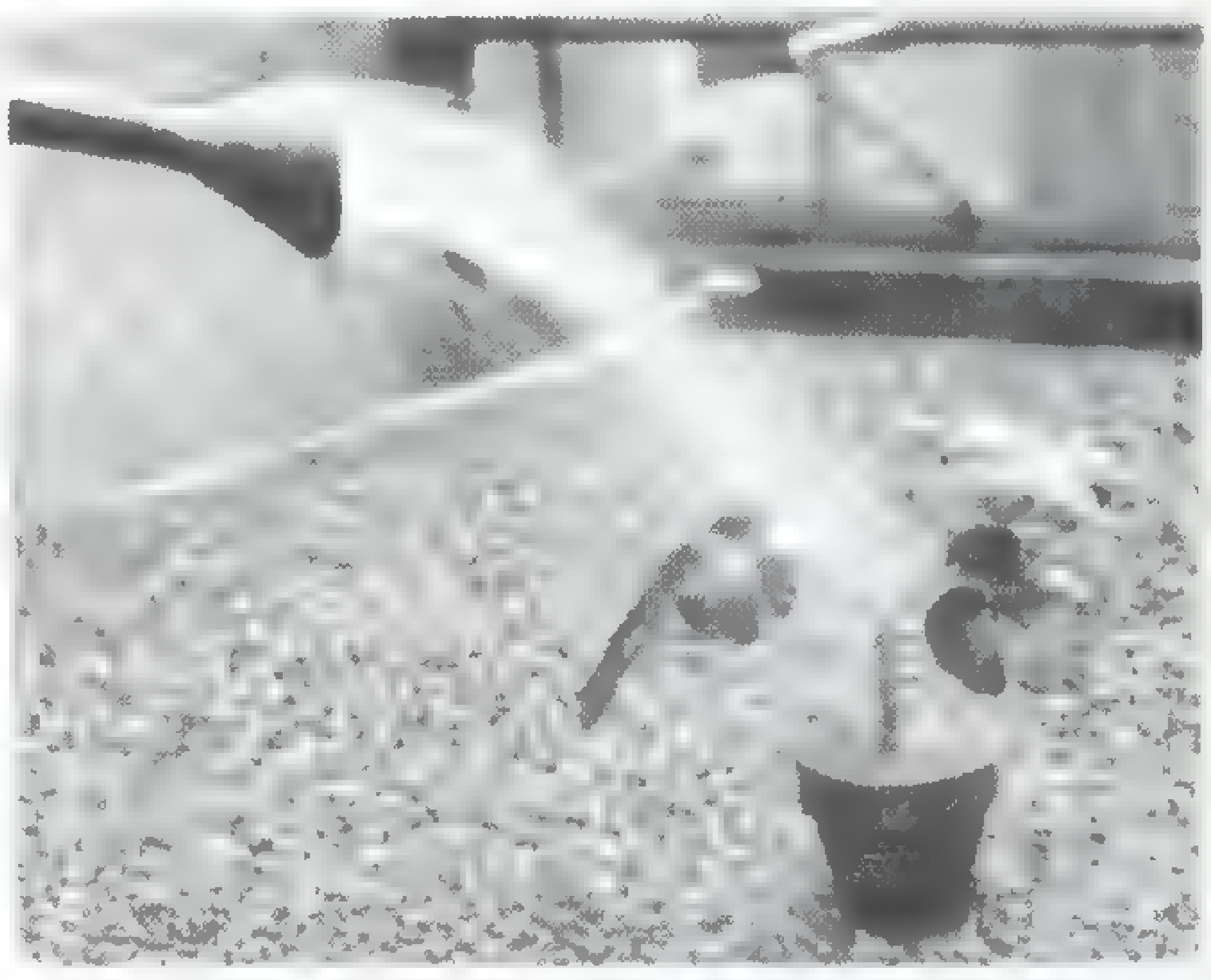
10. SHADE FOR SEVERAL DAYS

1. REMOVING ROOTED CUTTING FROM SAND

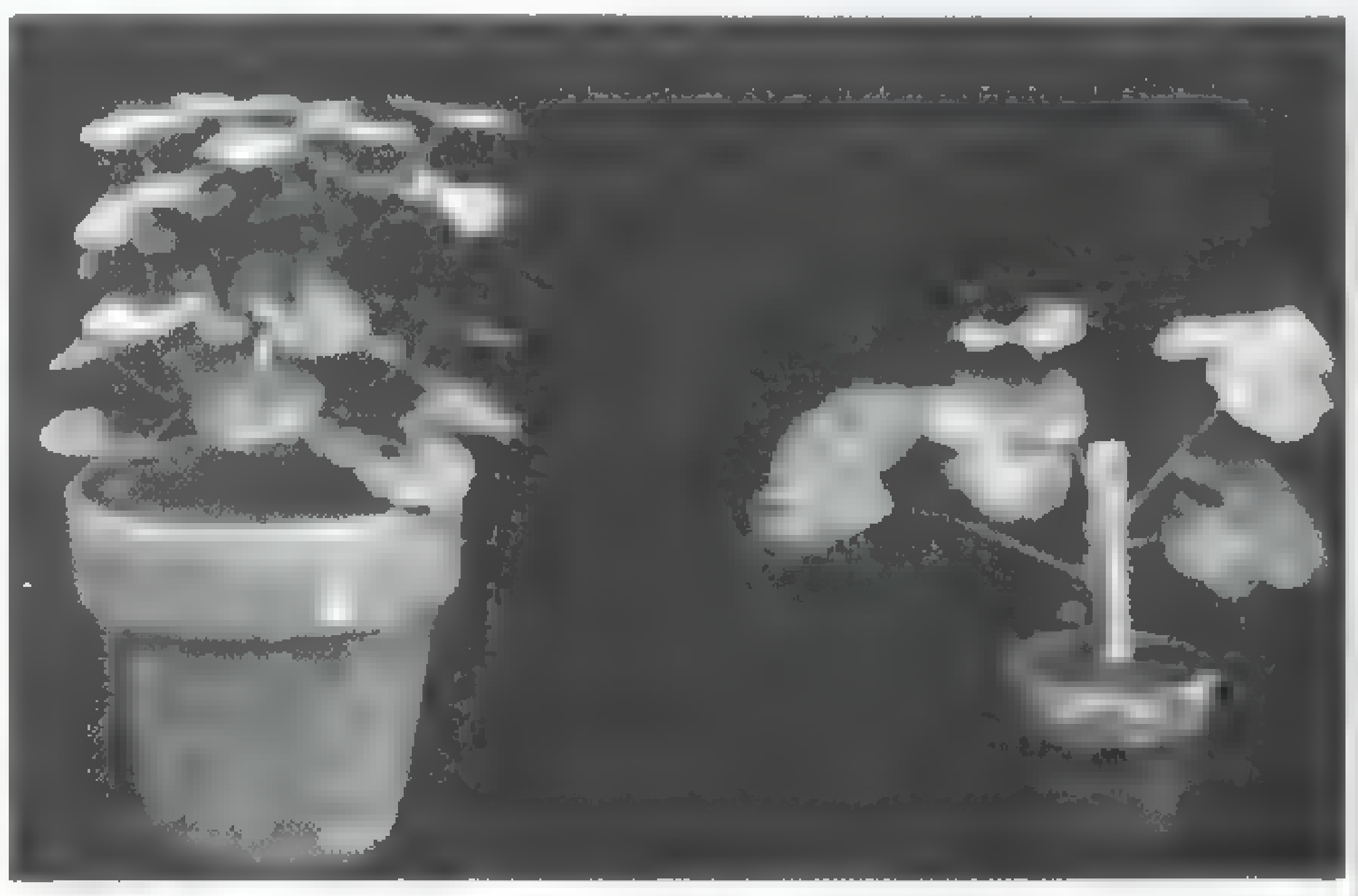


2. UNROOTED AND ROOTED CUTTING

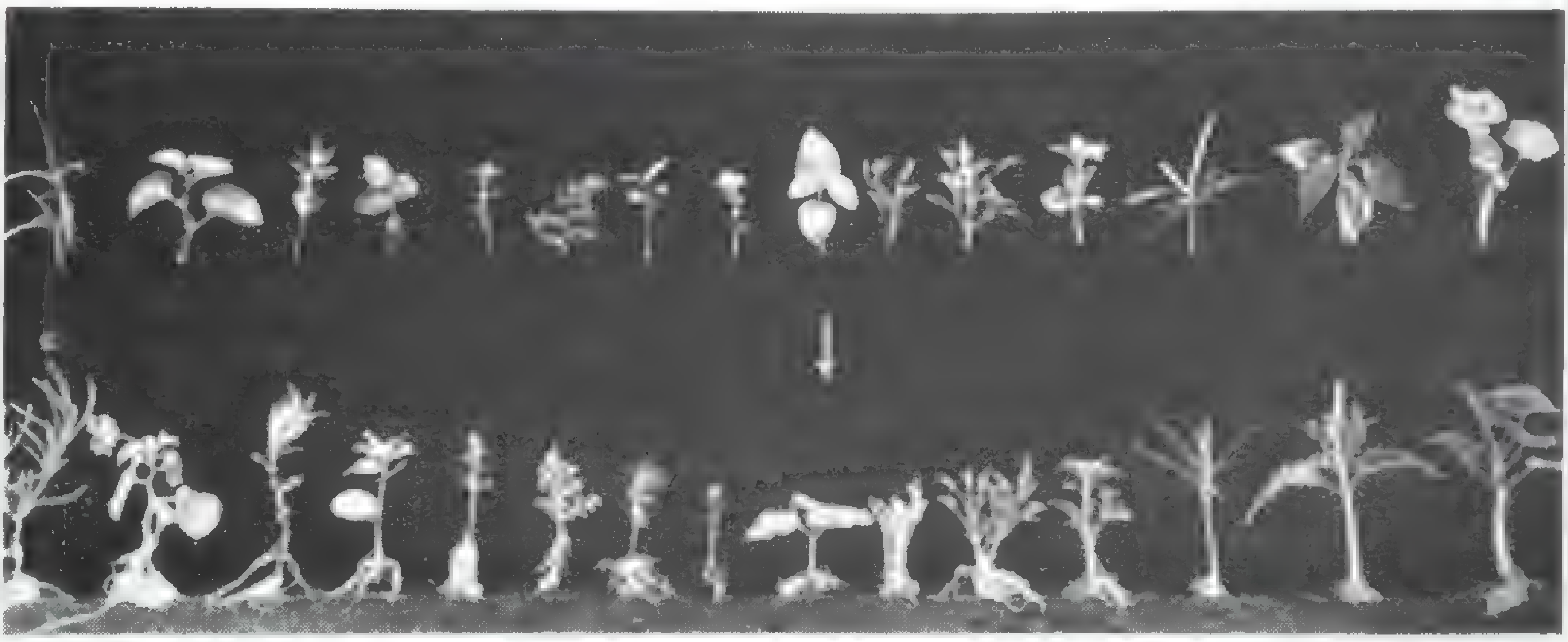
3. POTTING THE YOUNG PLANT



4. WATER, SHADE SEVERAL DAYS



5. STOCK PLANT, OFFSPRING



6. SOFT-WOOD CUTTINGS OF VARIOUS PLANTS

a sprinkling can, newspaper for temporary shade, and a fair amount of patience are about all one needs.

To avoid casualties due to disease fungi which often destroy cuttings, observe the following suggestions carefully:

1. Use sterilized equipment whenever possible.
2. Always use clean sand.
3. Keep the sand just moderately moist, not soaking-wet.
4. Fresh air and good circulation are important.
5. Do not over-crowd the cuttings.
6. The temperature should be about 65°-75° F.
7. Cuttings that have started to root need lots of direct sunlight.
8. Remove all dead or diseased cuttings from the sand.

Soft-wood cuttings.—Stem cuttings may be separated into three general groups: (1) soft-wood, (2) half-ripened wood, (3) hard or dormant wood. To outline the various details of stem propagation by soft or green-wood cuttings which are commonly called "slips," let us consider the common geranium (pls. 22 and 23).

The stock plant from which the cuttings are to be taken should be healthy, vigorous, and well branched. The slips are made from wood that is brittle and snaps off readily when bent. Shoots of young succulent wood rot quickly in the sand, while old fibrous stems are always slow to root and produce inferior plants. Terminal or tip cuttings are generally preferred. The main shoots of some plants, such as the large-leaved rhododendrons which have considerable pith, are usually removed to force the development of lateral growths that have a greater proportion of wood and root more readily. Old plants can be "headed back" this way to get new lateral shoots for cuttings. Slips about four inches long are cut off the stock plant with a sharp knife. The leaves are removed from one or two nodes at the base of the cutting, but do not reduce the leaf area of the top unless it is excessively large and inconvenient. Leaves manufacture food which is necessary for the development of a new root system. If too many leaves are cut off, the plant is liable to suffer from malnutrition, and in this weakened condition is more susceptible to damping-off fungi. The cuttings will naturally shed any excess foliage, so do not reduce the tops unless they are inconvenient or have a tendency to wilt badly.

All flower buds should be removed and the stem cut off clean just below the basal node. Geranium cuttings do better if lightly sprinkled with water and exposed to the air for several hours before being placed in the sand. This permits the wounded cells to heal over and discourages that pesky rot which specializes only on the best varieties! To prevent wilting, most soft-wood cuttings are kept in a pail of water or wet newspaper until placed in the sand. Cuttings that have a milky sap are best dried for a few hours, as with geraniums. The base of the cutting is inserted in holes or trenches made in the sand with a dibble, one or more nodes being covered to insure good rooting. Some propagators advocate pressing the slips into the sand without the aid of a dibble, but unless one is very careful the plant tissues are apt to be injured. The sand should be firmed gently around the stem to avoid air pockets and the cuttings thoroughly watered. Shade with newspaper, cheese-cloth, or lath for about one week, and then expose to full sunlight. Keep the sand barely moist.

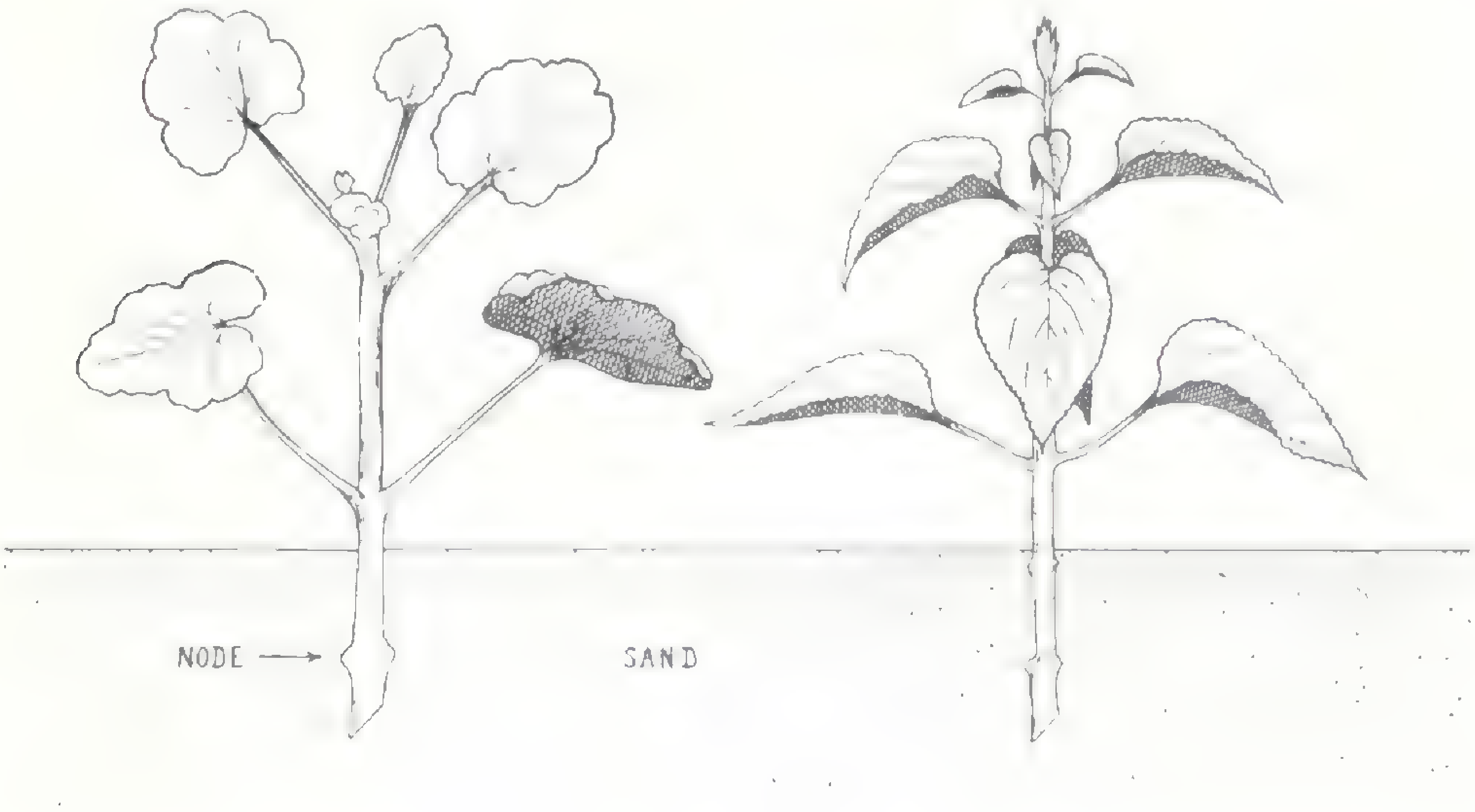


Fig. 3. Cuttings placed in sand.

A temperature of 70°-75° is favorable to rooting, and if possible use mild bottom-heat. In about three to four weeks the cuttings will form roots at least one-half inch long. The young plants should then be removed from the sand and potted up in a heavy loam soil containing an abundance of organic matter (leaf mold, manure, compost, or peat). Water the plants well and shade for a few days until the roots become established.

House plants, as well as a large portion of the garden and greenhouse stock, are generally increased by soft-wood cuttings. A few examples are shown in pl. 23, fig. 6. Cuttings root differently at various time of the year. Tender plants can be propagated to advantage during fall and winter when the sunlight is not too intense and bottom-heat is available. Hardy herbaceous perennials are easily increased by this method in the spring when the plants have new shoots seven or eight inches tall. Select the stems which are firm, not too soft, and always leave a few buds on the stock plant for future growth. Cuttings can also be rooted in summer if shaded from direct sunlight and watered properly.

PLANTS INCREASED BY SOFT-WOOD CUTTINGS

ANNUALS AND TENDER PERENNIALS

Abutilon—Flowering Maple
Acalypha—Chenille Plant
Ageratum—Floss-flower
Alternanthera
Antirrhinum—Snapdragon
Ardisia
Begonia semperflorens
Beloperone—Shrimp Plant
Buddleia—Butterfly Bush
Cacti
Chrysanthemum
Codiaeum—Croton
Coleus
Conservatory plants—many kinds
Crassula
Cuphea—Cigar Plant
Dahlia
Erica—Heather
Euphorbia—Poinsettia
Ficus elastica—Rubber Plant
Fuchsia—Lady's Ear-drops
Gardenia
Genista
Hedera—English Ivy
Heliotropium—Heliotrope
Hibiscus—Rose-mallow
Hydrangea
Impatiens
Ipomoea—Sweet-potato
Iresine—Blood-leaf
Lantana
Lobelia
Mesembryanthemum
Oplismenus—Variegated Grass
Pelargonium—Geranium
Philodendron
Pilea—Artillery Plant
Plumbago capensis—Leadwort
Salvia—Sage
Santolina—Lavender-cotton
Sedum—Stonecrop
Selaginella
Senecio confusus
Stevia
Strobilanthes
Succulents—many kinds
Swainsona
Tradescantia—Wandering Jew
Verbena
Vinca major—Periwinkle
Zebrina pendula—Purple Wandering Jew

Hundreds of hardy perennials can be propagated by soft-wood cuttings. A few of the more common ones are:

HARDY HERBACEOUS PERENNIALS

Althaea rosea—Hollyhock
Alyssum saxatile—Golden-tuft
Amsonia
Arabis—Rock-cress
Arenaria—Sandwort
Asclepias tuberosa—Butterfly-weed
Aster
Aubrietia—Purple Rock-cress
Boltonia
Campanula—Bellflower
Caryopteris
Centaurea Cyanus—Cornflower
Ceratostigma plumbaginoides—Blue Leadwort
Chrysanthemum
Clematis
Delphinium—Larkspur
Dianthus—Pink
Eupatorium coelestinum—Mist-flower
Gaillardia—Blanket-flower
Gypsophila—Baby's-breath
Helenium
Helianthus—Sunflower
Heliopsis—Orange Sunflower
Hesperis—Sweet Rocket
Heuchera—Coral Bells
Iberis—Evergreen Candytuft
Lobelia
Lychnis—Campion
Lythrum—Loosestrife
Mentha—Mint
Monarda—Horse-mint
Myosotis—Forget-me-not
Penstemon—Beard-tongue
Phlox
Polygonum—Fleece-flower
Potentilla—Cinquefoil
Ranunculus—Buttercup
Rudbeckia—Coneflower
Salvia—Sage
Saponaria—Soapwort
Sedum—Stonecrop
Silene—Catchfly
Solidago—Goldenrod
Teucrium—Germander
Tradescantia—Spiderwort
Veronica—Speedwell
Viola—Pansy
Yucca—Adam's-needle

Summer cuttings of woody plants.—During the summer, two types of cuttings can be made from ornamental shrubs and other woody plants: (1) soft-wood from young shoots which have a texture similar to the stems of a geranium, (2) half-ripened wood that has nearly completed growth. Cuttings made from young green shoots are handled in the same manner as "slips," except that a frame or Wardian case is practically necessary for rooting.

The half-ripened wood cuttings with leaves attached quickly strike root and develop into well established little plants for setting out the following spring. The cuttings may be taken from May to September, the time depending on when the plant makes its new growth. A shaded sash frame outdoors or in the greenhouse is ideal for this purpose, but if only a few cuttings are to be rooted, a small box with a glass cover is satisfactory. Inverted fruit jars are also effective.

The cuttings should be about six inches long and just brittle enough to snap off when bent double. The tip ends of the shoots are commonly used, but in some cases other parts of the stem will also root. The leaves are removed from two or three nodes at the base of the cutting and a clean cut made just below the basal node. The lower portion is then buried in sand several inches and the cuttings watered as usual. The frame should be covered tightly with sash to maintain a close humid atmosphere. An occasional spraying with water (in the morning) will help to prevent the foliage from wilting. Do not keep the sand too wet. The cuttings will generally root in four to six weeks, then they can be transplanted to nursery beds or placed in flats of soil and kept in frames. The young plants are benefited by a protective mulch during winter or they may be held over in cold-frames to avoid alternate freezing and thawing. In spring the plants can be moved to permanent quarters.

Summer cuttings are easily made of the following shrubs:

Abelia—Bush-arbutus
Acanthopanax—Five-leaf Aralia
Aronia—Chokeberry
Azalea
Berberis—Barberry
Buddleia—Butterfly-bush
Buxus—Boxwood
Calycanthus—Sweet-shrub
Chionanthus—Fringe-tree
Cornus—Dogwood
Cotoneaster—Rock-spray
Cytisus—Broom
Deutzia
Exochorda—Pearl-bush
Forsythia—Golden-bell
Hibiscus syriacus—Shrub-althea
Hydrangea
Kerria
Kolkwitzia—Beauty-bush
Ligustrum—Privet
Lonicera—Honeysuckle
Mahonia—Holly-grape
Philadelphus—Mock-orange
Rhodotypos—Jetbead
Spiraea
Symphoricarpos—Snowberry
Syringa—Lilac
Viburnum
Vitex—Chaste-tree
Weigela

Hard-wood cuttings.—Many shrubs, trees, and vines are propagated by this method. The cuttings are taken in the fall or during the winter when the wood of the previous season's growth is fully ripened and dormant. It is an advantage to take the cuttings in autumn as they will callus and often root before planting out in the spring. Some hard-wood cuttings can be planted outdoors in the fall in ordinary soil and will callus without difficulty if given slight winter protection. As a rule, however, the dormant shoots are cut up into pieces about six inches long and tied in convenient bundles with the tops all one way. The cuts are best made at or near the basal nodes and the lower buds rubbed off to prevent suckering when planted. The bundles are stored in boxes of moist sand, soil, or peat in a cool cellar. By the time spring arrives, the lower ends of the cuttings will have formed prominent calluses. The same results can be obtained outdoors by burying the bundles in sandy soil below the frost line. A mulch over the top of the soil will retard deep freezing.

In spring the callused cuttings are planted upright in the nursery row a few inches apart. The planting depth varies according to the nature of the cutting, but it is customary to leave approximately one-third of the stem above the soil, thus permitting one or several buds to develop into new shoots. In the fall the young plants can be moved as desired.

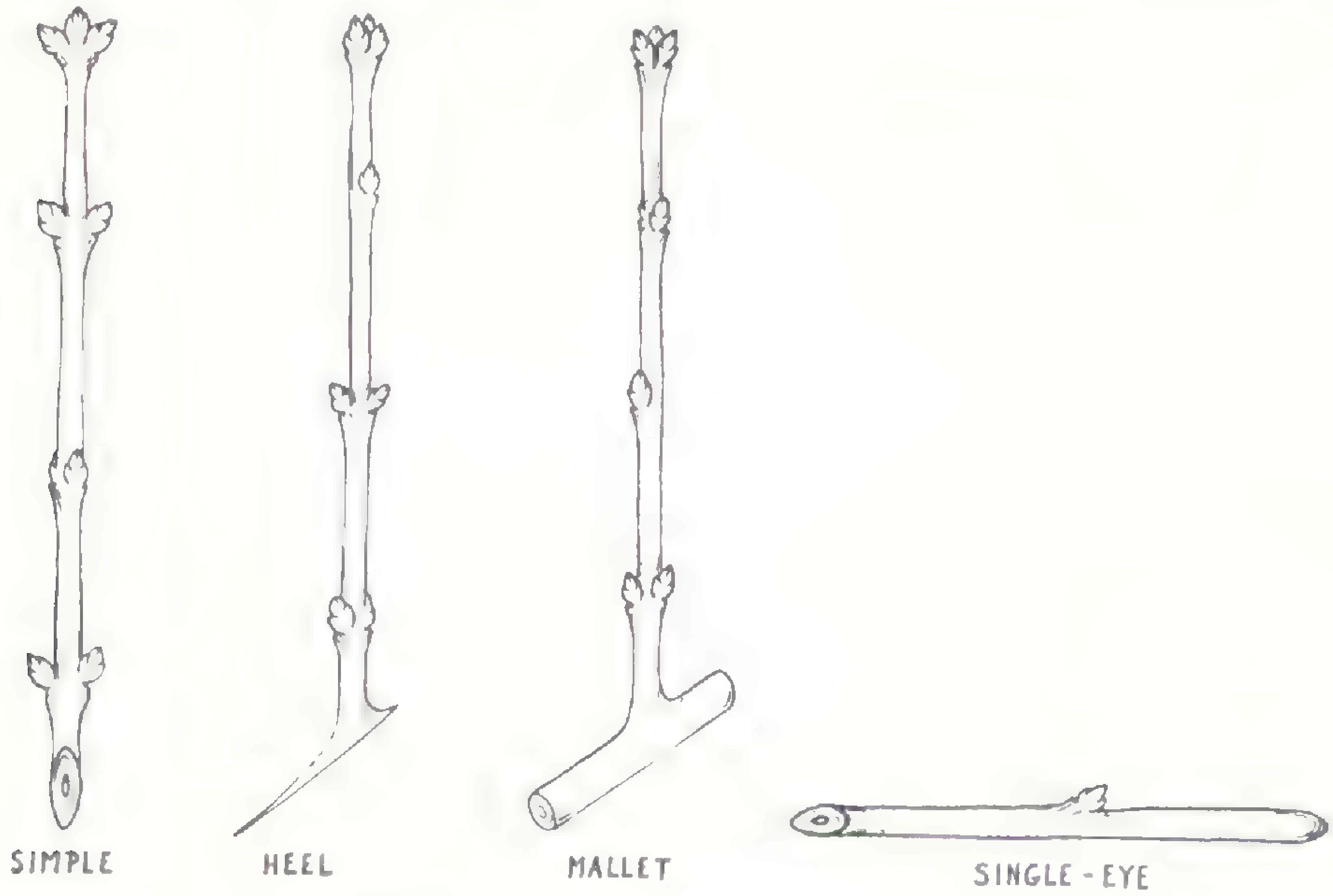


Fig. 4. Types of hard-wood cuttings.

Short pieces of woody stem having only one eye or bud can frequently be used as cuttings. They should be started under glass with bottom-heat. The small pieces of stem are imbedded horizontally one inch deep in sand, the bud facing upward. When roots and shoots form, the young plants are potted up in soil and later set out in the field.

Various types of hard-wood cuttings are illustrated in figure 4. The heel and mallet types are useful with plants such as evergreens which root very slowly. Cuttings of evergreens are handled in the same way as summer cuttings except that mature wood of the past season's growth is taken in fall after frost.

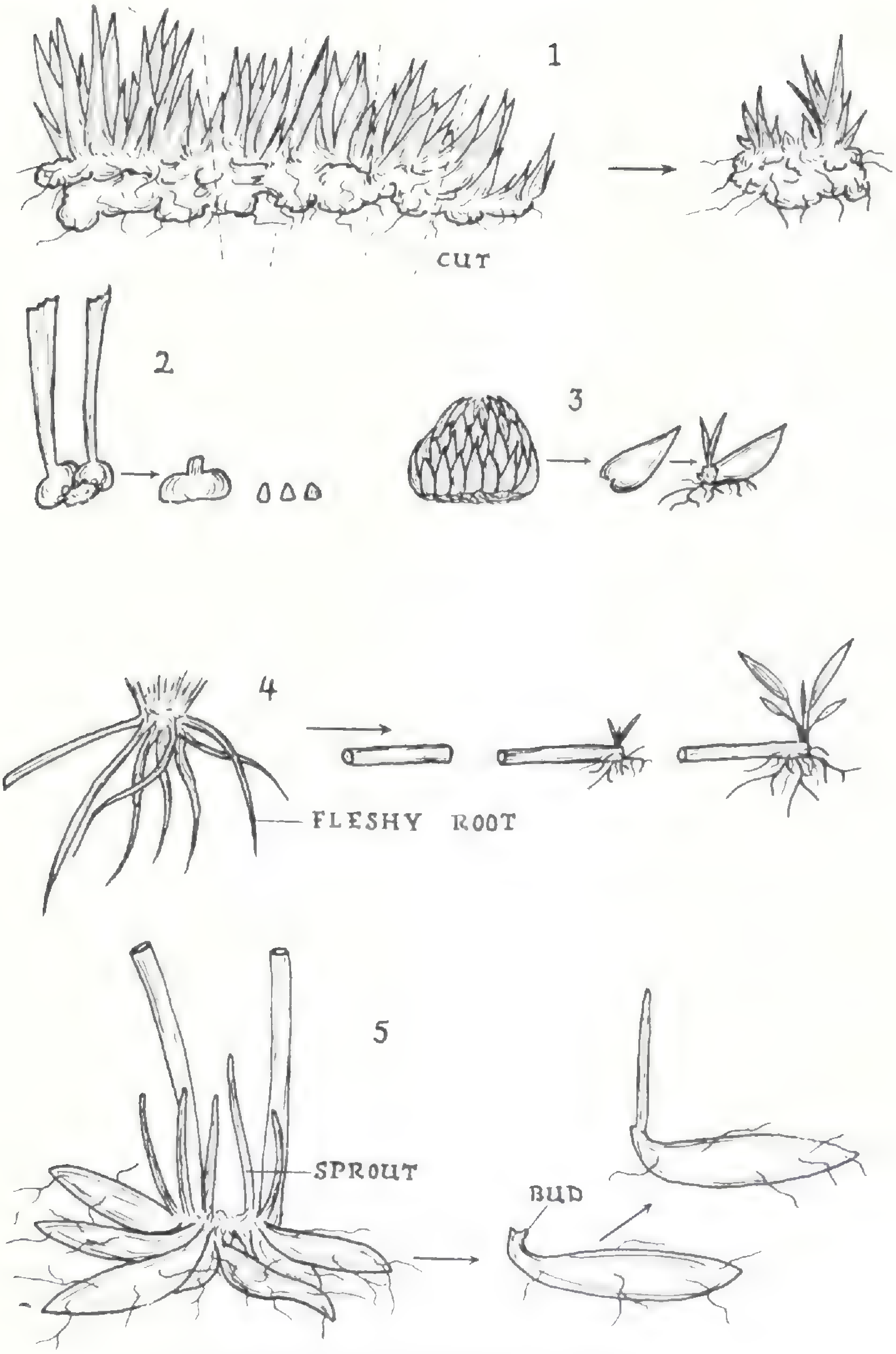
The following plants, as well as most of the shrubs mentioned in the foregoing list, are readily propagated by hard-wood cuttings:

Akebia
Ampelopsis—Virginia Creeper
Campsis—Trumpet Creeper
Catalpa
Cephalanthus occidentalis—Buttonbush
Chaenomeles—Flowering Quince
Crataegus—Hawthorn
Elaeagnus—Russian Olive
Euonymus—Burning-bush
Nerium—Oleander
Physocarpus—Ninebark
Populus—Poplar
Pyracantha—Firethorn
Rhamnus—Buckthorn
Rhus—Sumac, Smoke-tree
Ribes—Currant
Sambucus—Elder
Staphylea—Bladder-nut
Tamarix—Tamarisk
Vitis—Grape
Wisteria

Rhizomes, runners, offsets, layers.—Some plants are propagated naturally and artificially by various kinds of stems which have become radically modified from the typical upright leafy forms. Many stems are weak and slender and lie prostrate on the ground where they frequently strike root, while others are climbers and support themselves on suitable objects. In certain cases they are partly or wholly subterranean, often being mistaken for roots. When stems normally contact the soil, they produce young plants of their own accord, but occasionally the process can be hastened by artificial methods.

Rhizomes or rootstocks.—A rhizome is an underground stem which generally bears roots, shoots, and leaves. Some rhizomes, such as those of certain Iris, are only partly subterranean, while others may penetrate rather deeply into the soil, as exemplified by the numerous slender rootstalks of plumbago *(Ceratostigma plumbaginoides)*. A rhizome is distinguished from roots by the presence of nodes, a true root having no such structures.

The German or common Iris is propagated by division of the rhizomes (pl. 24, fig. 1). A large clump is dug up and divided into a number of small pieces, each having two or three sprouts for new growth. These fragments, when planted separately in the garden, soon develop into sizable specimens. When the rhizomes are slender and bear no prominent shoots, they are cut up into short pieces and rooted in sand before planting outdoors. The


1
CUT
2
3
4
FLESHY ROOT
5
SPROUT
BUD

(From Fairburn's *Plant Propagation*)

PROPAGATION BY RHIZOMES, CORMS, BULBS, AND ROOTS

1. Division of rhizomatous iris. 2. Gladiolus corms and cormels. 3. Lily increased by scales. 4. Root cuttings of Oriental poppy. 5. Division of dahlia clump.

cuttings are placed horizontally and covered with about one inch of sand or set upright with the lower portions embedded an inch or more in the sand. After roots and shoots have formed the young plants are potted up in soil and later transferred to the garden.

Unfortunately, two very pestiferous weeds, quack grass and bindweed (wild morning-glory), are propagated by rhizomes. Cultivation severs the rootstocks, and a new vigorous crop soon appears from these cuttings. For this reason they are very difficult to eradicate.

The following plants are propagated from rhizomes:

Achimenes
Agropyron—Quack Grass
Asarum—Wild Ginger
Aspidistra—Cast-iron Plant
Canna
Convallaria majalis—Lily-of-the valley
Convolvulus—Bindweed
Ferns—certain kinds
Helleborus—Hellebore
Holcus halepensis—Johnson Grass
Hosta—Plantain Lily
Iris—rhizomatous types
Narthecium—Bog Asphodel
Nymphaea—Hardy Water-lilies
Podophyllum—May-apple
Polygonatum—Solomon's-seal
Primula Seiboldi
Rheum Rhaponticum—Rhubarb
Sanguinaria—Bloodroot
Smilacina—False Solomon's-seal
Trillium—Wake-robin

Runners.—In some plants the stems are in the form of runners which creep along the surface of the ground and strike root at the nodes, producing new plants. Independence from the parent plant is established by the death or severance of the connecting stem after the offspring has developed roots and shoots. This method of increase permits the young plant to receive nourishment from the parent until it is able to shift for itself. Familiar examples of plants that propagate by means of runners are:

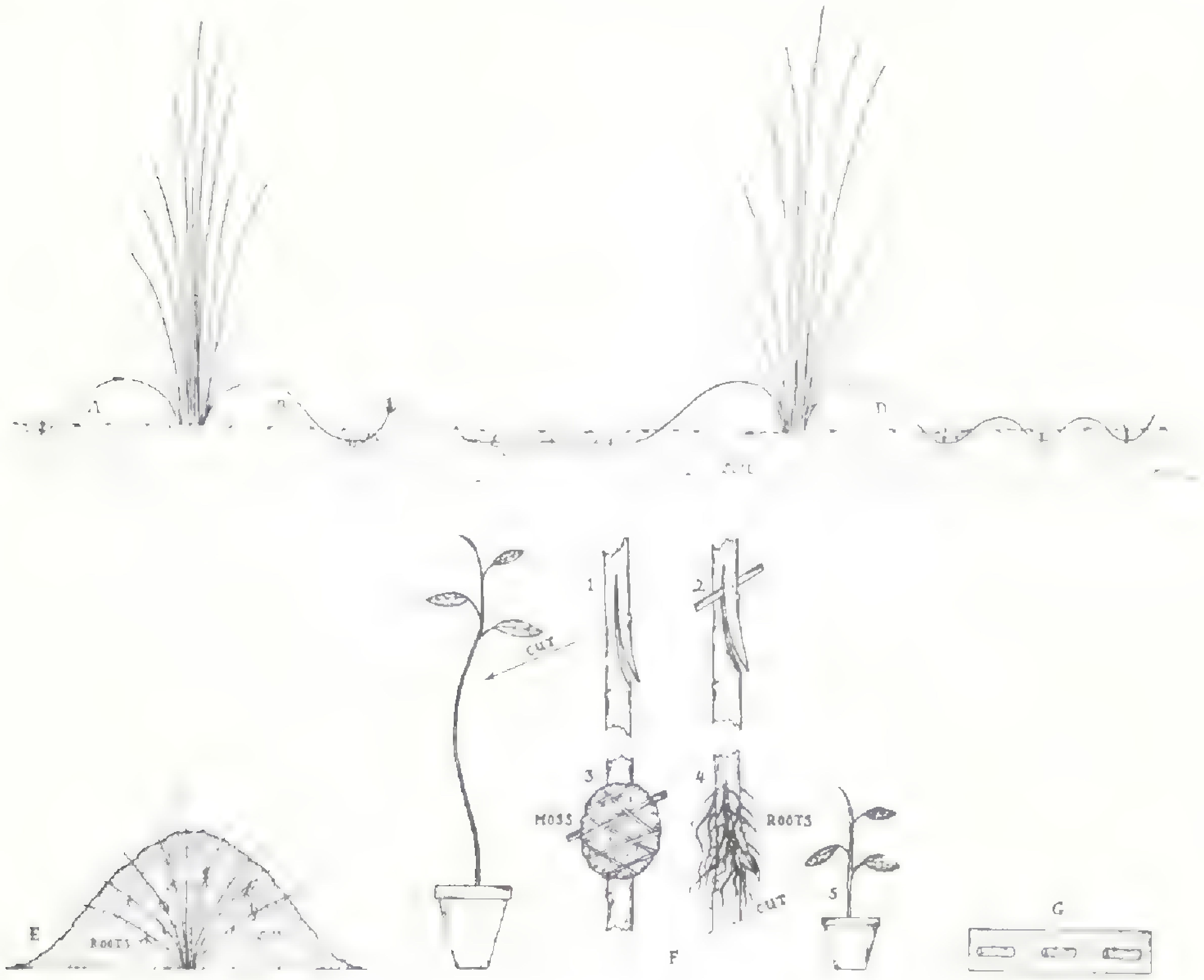
Fragaria—Strawberry
Nephrolepis—Boston Fern
Saxifraga sarmentosa—Strawberry Saxifrage

Offsets.—Many plants produce small rosettes or leafy shoots near the base of the parent plant. These offsets are sometimes attached to the parent by a short stem (pl. 26, fig. 5), but in other cases they cling directly to the main stem. When the offsets are borne next to the surface of the soil, it is an easy matter for them to strike root and eventually become independent. Offsets that do not contact the soil can be removed and placed in moist sand where rooting will occur in a short time.

The following plants increase by offsets:

Ananas sativus—Pineapple
Anthericum—St. Bernard Lily
Billbergia
Cotyledon
Echeveria
Eichhornia crassipes—Water-hyacinth
Marica
Pandanus—Screw-pine
Phoenix dactylifera—Date Palm
Pistia Stratiotes—Water-lettuce
Sempervivum—Houseleek
Tillandsia

Layers.—Sometimes the stems or branches come in contact with the soil and take root at the nodes while still attached to the parent. Many plants do this unaided, while others require the gardener's assistance. It is one of the simplest and most dependable methods of propagation and is known as layering. It is often successful when cuttings fail, being especially useful with hard-wood material. For example, some rhododendrons are almost impossible from cuttings but respond well to layering.



(From Fairburn's *Plant Propagation*)

Fig. 5. TYPES OF LAYERING

A, Tip. B, Simple. C, Continuous. D, Serpentine. E, Mound. F, Chinese or air. G, Woody stem cut into small sections and layered in sand or moss.

There are several different types of layering. To make a *simple* layer, a branch is bent over to the ground and partly covered with sand or soil, the tip end being left exposed. The branch is held in place by the weight of the material covering it or by some type of anchor. That portion of the branch which is to be buried should have all the leaves removed unless they are sufficiently long-stemmed to extend above the surface. With woody stems a short cut or notch is made at each node that is to be covered, to stimulate root formation. The cut should be propped open with a match or toothpick. When the layer is well rooted, connection with the parent is severed, and the young plant removed. Layering outdoors is usually done in the spring and summer. Embed the young growing shoots in a light sandy soil and keep the soil moist at all times. In the greenhouse, plants can be layered any time during the year, using sand, peat, or soil as a rooting medium.

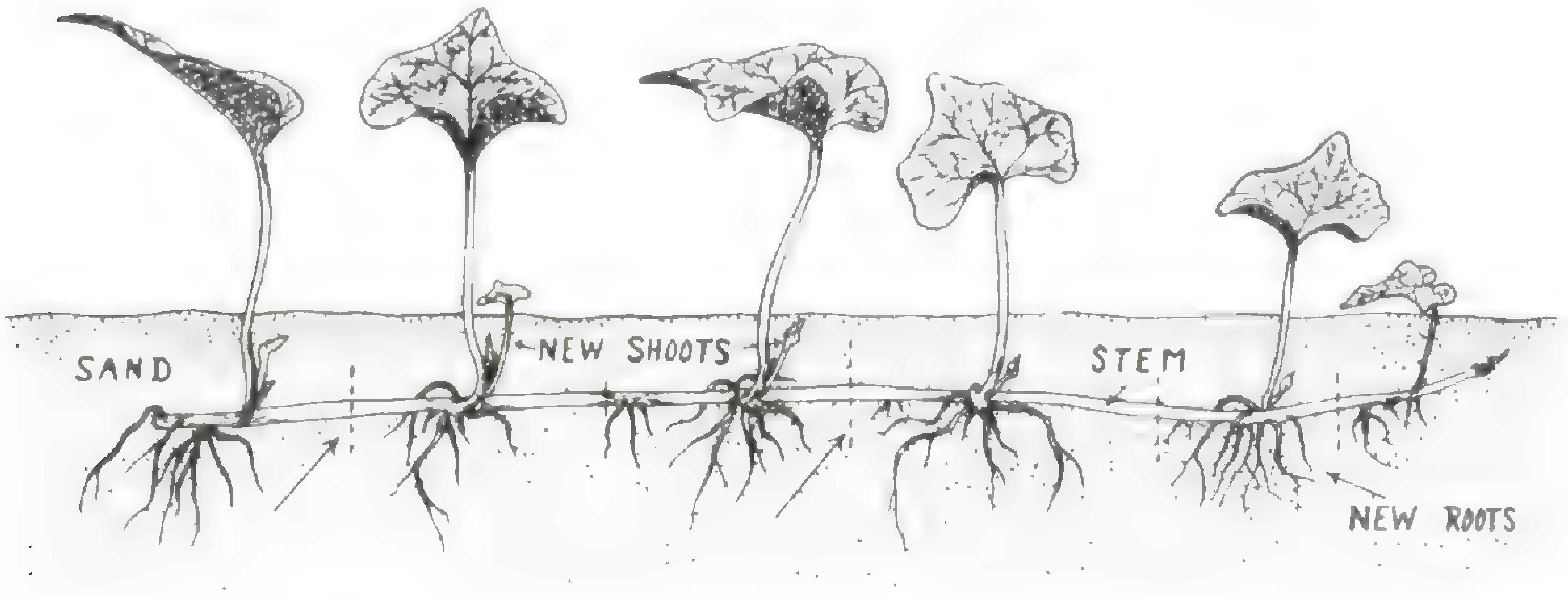


Fig. 6. Propagation by continuous layering.

Tip layering is commonly used with black raspberries and similar plants. The canes are bent over in late summer and the tips anchored in the soil. Roots and shoots soon appear at the tips, forming new plants which are cut from the supporting canes in the fall or spring and planted separately. Tip layering is illustrated in fig. 5, A.

Vines with long flexible stems are often propagated by *serpentine layers* (fig. 5, D). Alternate sections of a single stem are embedded in the sand or soil. Roots appear on each submerged scallop and a large number of plants are obtained.

In *continuous* layering, practically the entire branch except the tip is covered. This type is used with a limited number of vines and shrubs, since many plants will not develop shoots from buds which are covered with sand or soil. Ivy, willow and high-bush cranberry are easily propagated in this manner (fig. 5, C, and fig. 6).

Mound layers are used to advantage with low-growing plants which have stems that are too stiff to bend satisfactorily. Gooseberries lend themselves readily to mound layering (fig. 5, E). The plants are pruned back severely to encourage branching at the base. Sandy soil is then mounded up around the new shoots which strike root at the nodes. The young plants develop rather slowly, often requiring two years to establish a good root system. Other plants propagated by this method are:

Azalea
Calycanthus—Sweet-shrub
Cotoneaster
Cydonia—Quince
Spiraea "Anthony Waterer"
Hydrangea

Greenhouse plants with rigid woody stems are often increased by Chinese or *air layering* (fig. 5, F). A slanting upward cut is made through one or more nodes on the stem and the cut propped open with a toothpick. A ball of damp sphagnum moss is then tied securely around the stem where the cut has been made. If the moss is kept moist and the plant exposed to a warm temperature, roots will soon form. The stem should then be cut off just below the ball of moss and the rooted section with moss intact potted up in soil to form a new plant. This is one way to reduce "leggy" or spindly plants to a desirable size. Another method is to cut the woody stems into short pieces and place them horizontally in damp moss or sand. Each piece will take root and form a new plant (fig. 5, G). Bottom-heat encourages rooting.

Bulbs, corms, tubers.—Many plants are propagated by bulbs, bulbels, bulb-scales, bulblets, corms, cormels, and tubers. These structures are simply modified stems and leaves which occur mostly underground. They contain large quantities of stored plant food, and under favorable conditions of moisture and temperature new plants are formed from dormant buds.

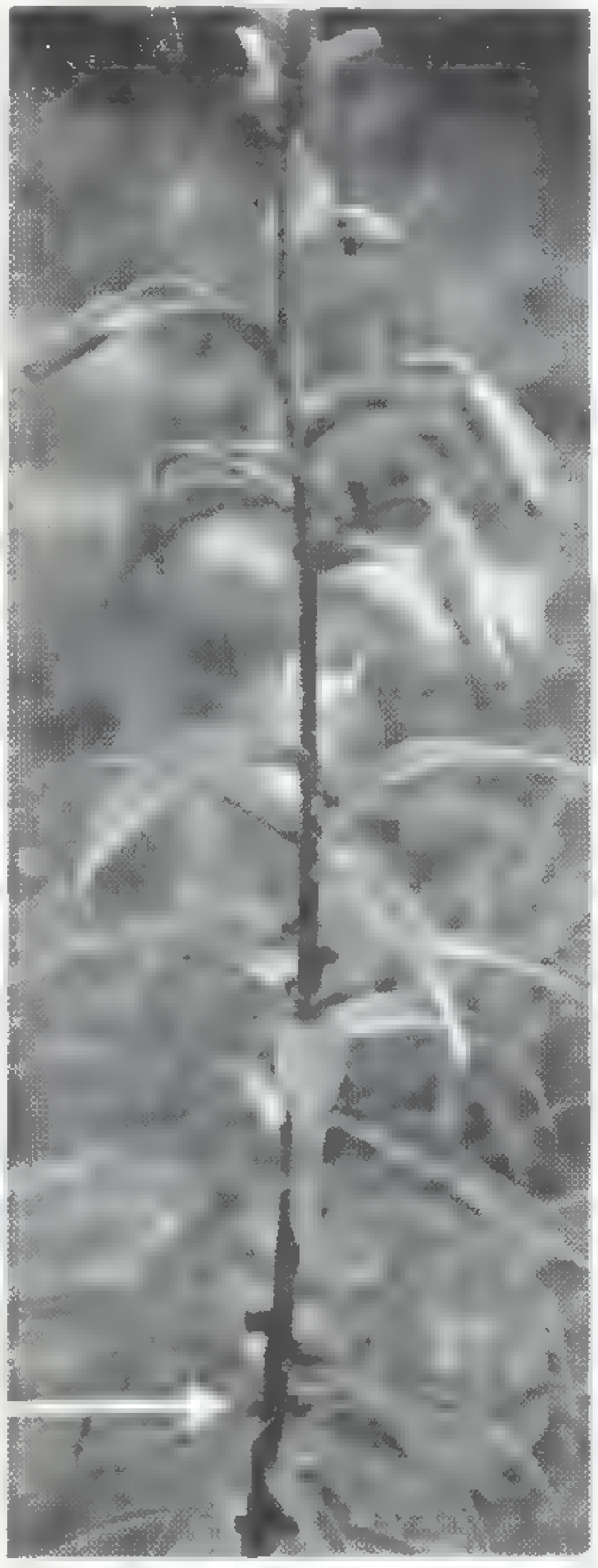
A *bulb* is a rounded underground structure composed mostly of fleshy scale-like leaves. There are two general types of bulbs: (1) tunicated, such as the onion, hyacinth, and tulip, which are composed of close-fitting layers of leaf tissue covered with a dry husk, (2) scaly, illustrated by the lily, which is made up of thick, loose, overlapping scales.

Bulbs are increased by natural separation. A mother bulb will produce one or more large bulbs or a number of small *bulbels.* If the bulbs are large enough, they will bloom within one year, but the small bulbels usually require several years to reach blooming size. When the mother bulb is dug, the bulbels are removed and replanted separately in pots, flats, or beds until they are large enough to produce flowers. Hardy bulbs, such as those of narcissus which increase rapidly, should be transplanted frequently to avoid crowding and subsequent non-flowering.

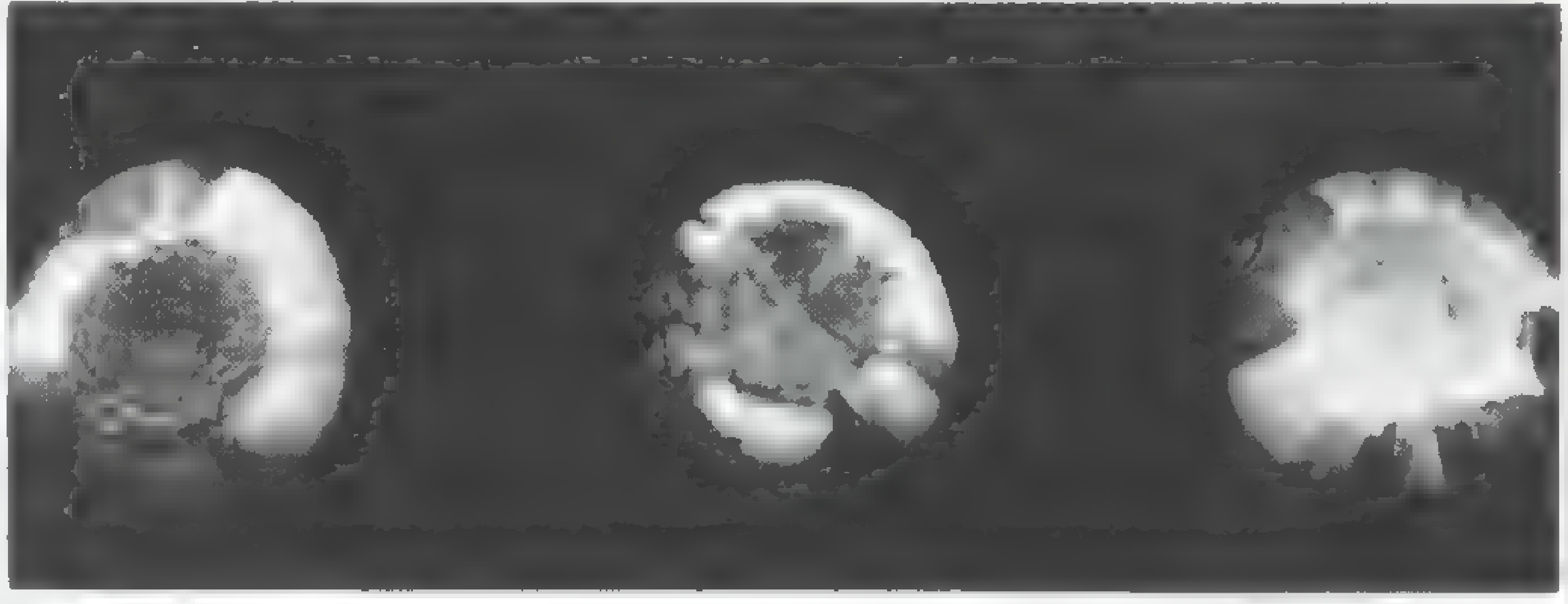
Hyacinths are propagated artificially by notching or scooping the bulbs when they are dug in spring and early summer (pl. 25, figs. 2 and 3). Making transverse cuts through the base of the bulb is known as notching. These cuts must not be too deep nor too shallow for good results. Any one not experienced in the art of making the notches will undoubtedly have some casualties. Scooping is also a delicate operation. The entire basal section of the bulb is removed in such a way that all the layers of scales are slightly severed. The wounded bulbs are dusted with slacked lime and placed bottom up in a moist chamber where the temperature can be maintained at 80° F. Within a few weeks small bulbels will start to form on the notched and scooped portions. The bulbs should remain in storage during summer and planted (with the young bulbels attached) outdoors in the fall. The bulbels then grow to maturity, being separated and replanted in special nursery beds the second year. Scooped bulbs produce more bulbels than notched ones, but they are small and require four to five years to reach flowering size. Notched bulbs form fairly large bulbels and flower in three to four years.

Lily bulbs are propagated by separation and are easily raised from the fleshy *scales* (pl. 25, fig. 4). Shortly after the bulbs have flowered, the scales are removed and placed in damp sphagnum moss in a warm greenhouse. Small bulbels will soon develop at the bases of the scales, and will flower in about three years. Another method is to plant the scales two inches deep in soil outdoors during the summer and leave them undisturbed until they flower some three years later.

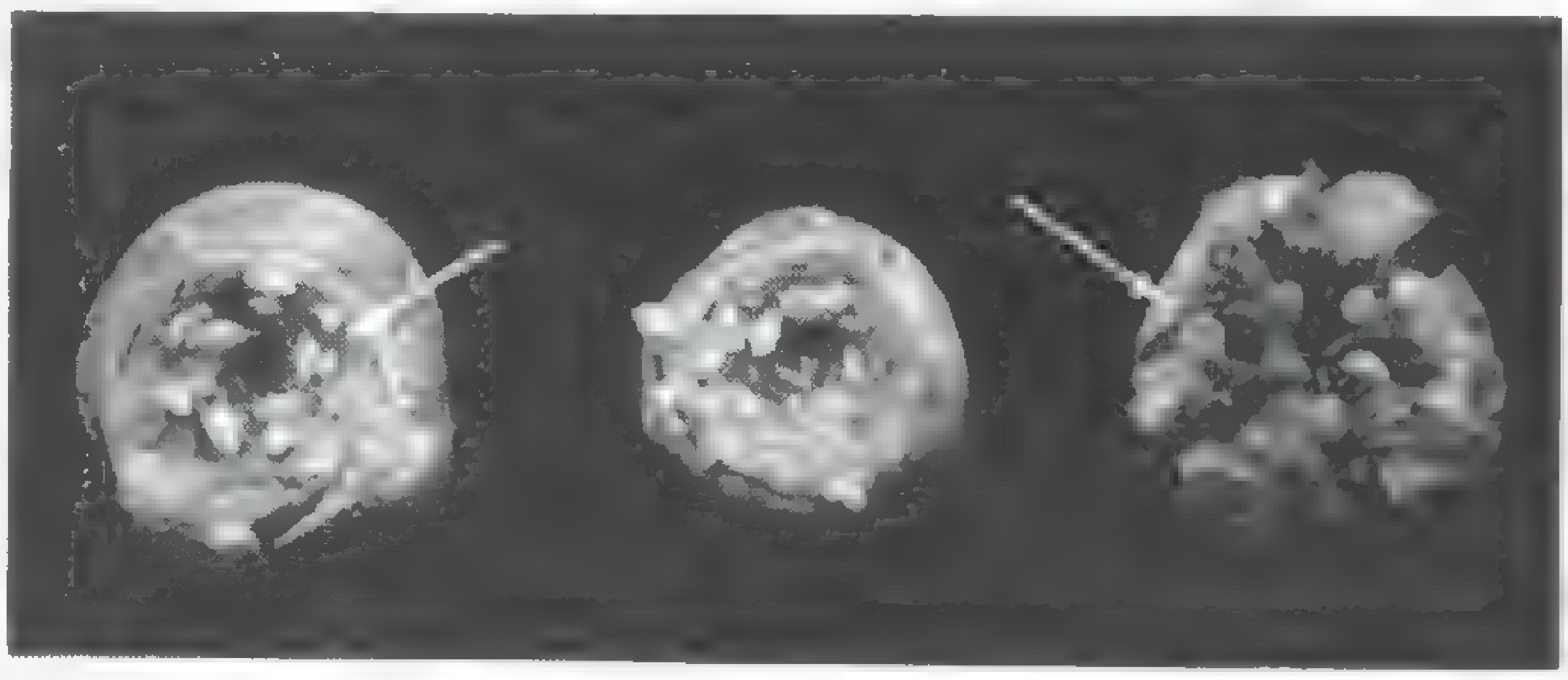
A few plants produce *bulblets* on the stems in the axils of the



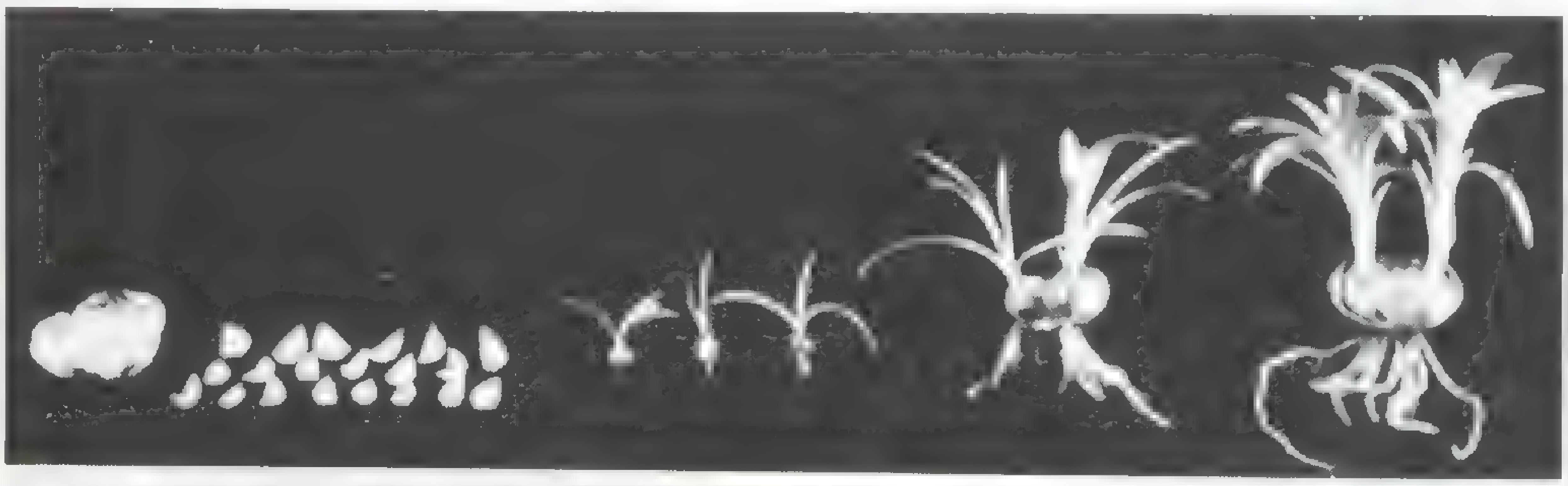
1. BULBLETS ON TIGER LILY



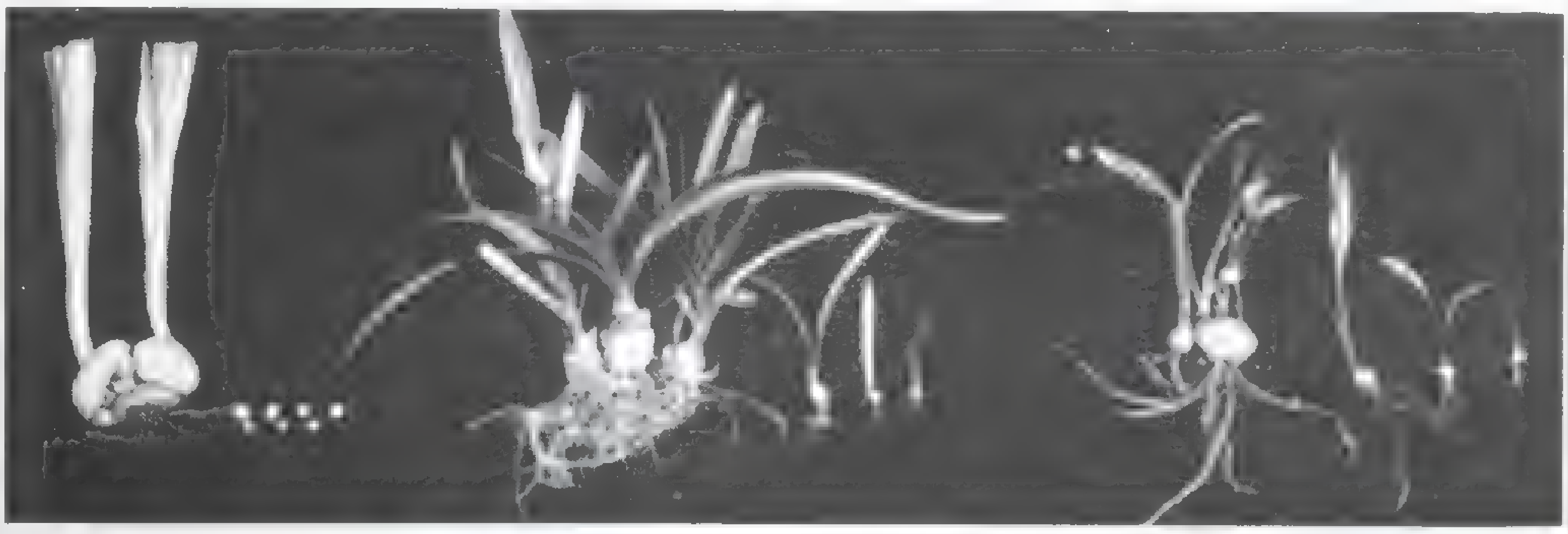
2. HYACINTH BULBS NOTCHED AND SCOOPED



3. BULBELS FORMING ON SCOOPED AND NOTCHED BULBS



4. LILIES INCREASE BY SCALES AND BULBELS



5. PROPAGATION OF GLADIOLUS, AMARYLLIS, LILY

leaves or in the flower cluster (pl. 25, fig. 1). When ripe these small bulblets drop off or are removed by hand and planted. Their culture is the same as for bulbels. In one to three years they will usually flower. Some of the plants increased by bulblets are:

Allium—Onion
Begonia Evansiana—Hardy Begonia
Ferns—certain kinds
Lilium (bulbiferum, Sargentiae, sulphureum, tigrinum)—Lily

The Madonna and several other lilies can be propagated from the lower part of the flower stem. After the flower has been cut off, the base of the stem is pulled out of the bulb and layered in sand. Small bulbs will arise from the prostrate stem and will flower in two or more years. Culture the same as for bulbels.

A *corm* is a rounded, fleshy, underground base of a stem. It is composed mostly of stem tissue, being solid like a potato, whereas a bulb consists mainly of leaf tissue and when cut open crosswise shows a number of concentric scaly rings. The gladiolus is a familiar plant that produces corms. Each year one or several new corms of flowering size are formed on top of the old mother corm which deteriorates at the end of the growing season (pl. 25, fig. 5). When the plant is dug in the fall, these new corms are separated and planted individually the following spring. Large corms may be cut into sections like a seed potato to produce more plants. *Cormels* are also formed at the base of the new corm. These cormels should be stored in fairly moist sand or soil until spring and then planted in rows like seed. In one to three years they will develop to blooming size.

The following plants propagate by corms:

Calochortus
Crocus
Cyclamen
Ixia
Sparaxis
Tigridia
Tritonia
Watsonia

Some plants, such as the common Irish potato and the Jerusalem artichoke, reproduce by *tubers*, which are thickened underground stems bearing conspicuous buds. These tubers may be planted whole or cut up into several pieces, each piece having at least one healthy bud. Seed potatoes are usually divided into three or four sections which are planted separately. Each section produces a new plant.

2. Propagation by Means of Roots

Cuttings.—Plants with thick fleshy roots can usually be propagated without difficulty from root cuttings. In certain cases, however, variegations are not transmitted by this method. The roots are cut up into pieces two or more inches long and planted horizontally about one inch deep in sand, moss, or soil. If bottom-heat is applied, new roots and shoots soon appear on the cuttings. Both hardy and tender plants can be propagated by this method in the greenhouse, but usually root cuttings of hardy stock are placed in pots or flats of sandy soil in the coldframe over winter. In spring the small plants are well established and ready to be set out in the garden.

Root cuttings of tender plants do well in the greenhouse if exposed to a moderately cool temperature. The cuttings can be made at any time of the year. Some thrive better if placed in the sand vertically with the ends slightly protruding above the surface, but when in doubt use the prostrate method.

The list of plants that can be propagated by root cuttings is of course extensive. A few examples are as follows:

Aesculus parviflora—Dwarf Buckeye
Ailanthus—Tree-of-heaven
Amelanchier—Shadbush
Anchusa—Bugloss
Bocconia—Plume Poppy
Bouvardia
Campsis—Trumpet Creeper
Caragana—Pea-shrub
Cirsium arvense—Canada Thistle
Chaenomeles—Flowering Quince
Crataegus—Hawthorn
Dicentra spectabilis—Bleeding-heart
Euphorbia—Spurge
Gypsophila—Baby's-breath
Halesia—Silver-bell
Paeonia—Peony
Papaver orientale—Oriental Poppy
Pelargonium—Geranium
Phlox—hardy type
Prunus—Plum, Cherry, Peach
Pyrus—Pear, Apple
Radicula Armoracia—Horseradish
Rhus—Sumac
Robinia—Locust
Rosa—Rose
Rubus—Raspberry, Blackberry
Sambucus—Elder
Staphylea—Bladder-nut
Syringa—Lilac
Taraxacum—Dandelion
Verbascum—Mullein
Wisteria
Xanthoceras
Yucca—Adam's-needle
Zanthoxylum americanum—Prickly Ash

Suckers.—Plants which produce suckers from the roots can also be readily increased by root cuttings. Willow, poplar, black locust, and sassafras propagate naturally by suckers, the shoots arising at various points along the roots. These adventitious growths can be separated from the parent and planted individually.

Tuberous roots.—The enlarged, fleshy storage roots of plants, such as the dahlia, sweet-potato, tuberous begonia, and caladium, are used for propagating purposes. Most tuberous roots (the dahlia excepted) have the ability to produce adventitious buds and form new plants. Merely plant the root in moist sand or soil and wait for developments. Sweet-potatoes sprout easily in a jar of water.

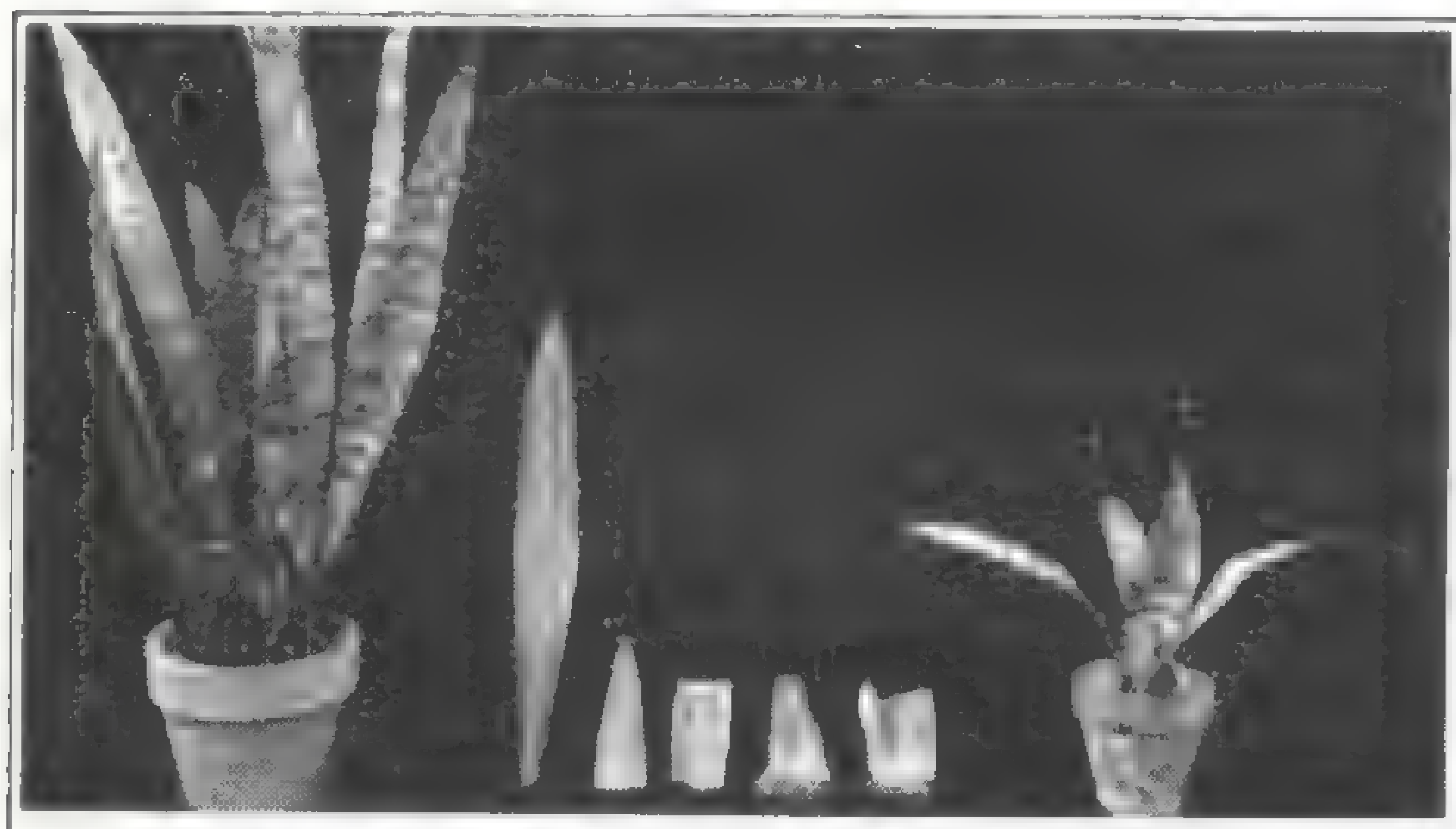
Dahlia clumps which have been stored in dry peat over winter should be divided in the spring when the buds begin to show at the base of the stem. The tuberous roots must be separated carefully in order that there be at least one bud to each division, otherwise no shoots will develop from the root when it is planted in the garden. Dahlia roots started in sand in the greenhouse about the latter part of April will form numerous shoots which can be used as cuttings (pl. 24, fig. 5).

3. Propagation by Means of Leaves

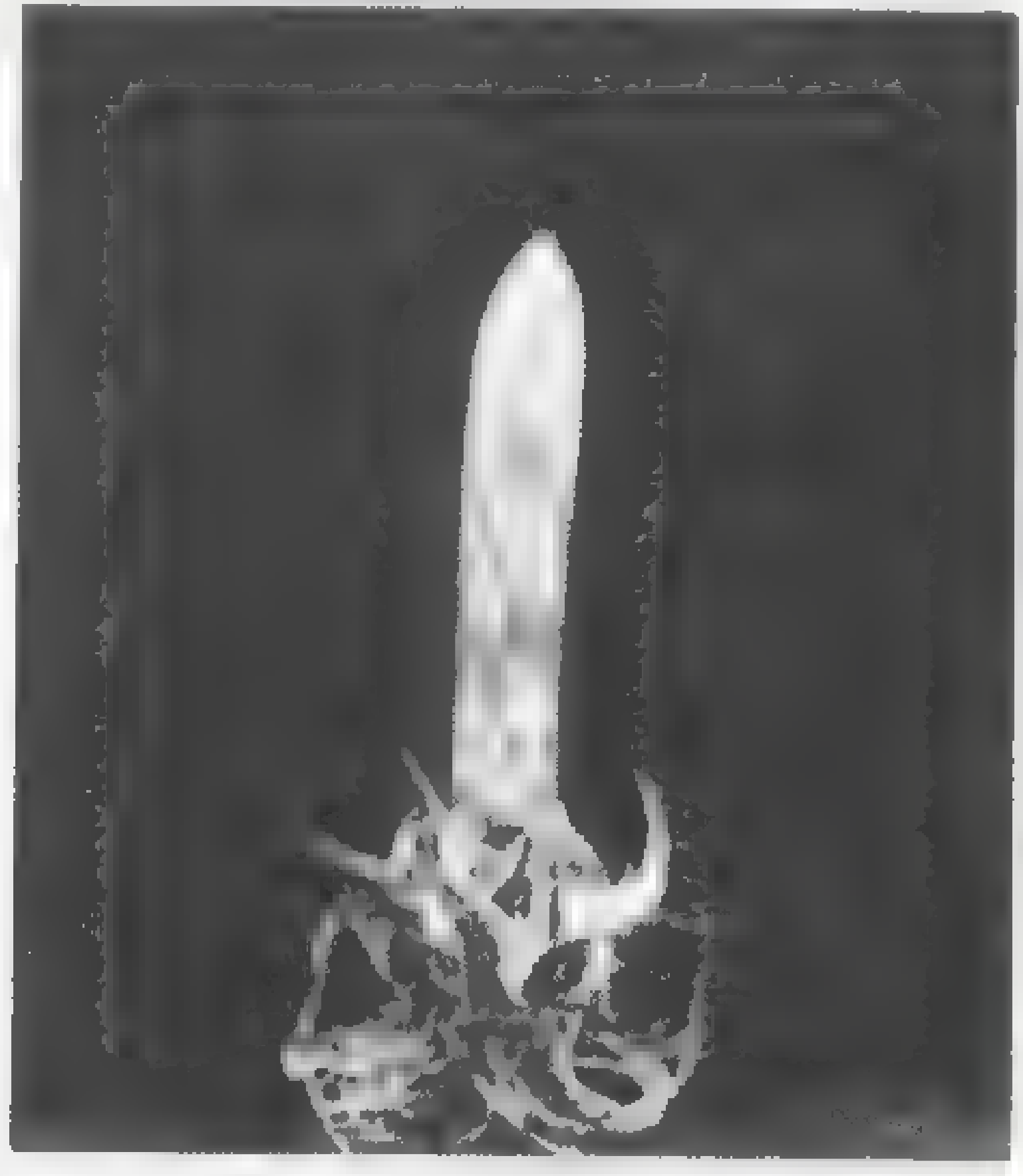
In addition to propagation by stems and roots, many plants have the ability to produce entire new individuals from leaves. This process may occur naturally as in the case of viviparous leaves, or artificially by various types of leaf cuttings.

Viviparous leaves.—Certain kinds of water-ferns, water-lilies, bryophyllums, and *Tolmiea Menziesii* develop young plants naturally on their leaves (pl. 26, fig. 3, and pl. 27, fig. 5). In due time the young plants will detach themselves from the parent leaf and fall to the ground or float away on the water to establish an independent plant. Thus a large plant may become surrounded with a host of offspring like a mother hen with a brood of chicks. In the garden and greenhouse, we usually assist nature by removing the plantlets and potting them up in soil.

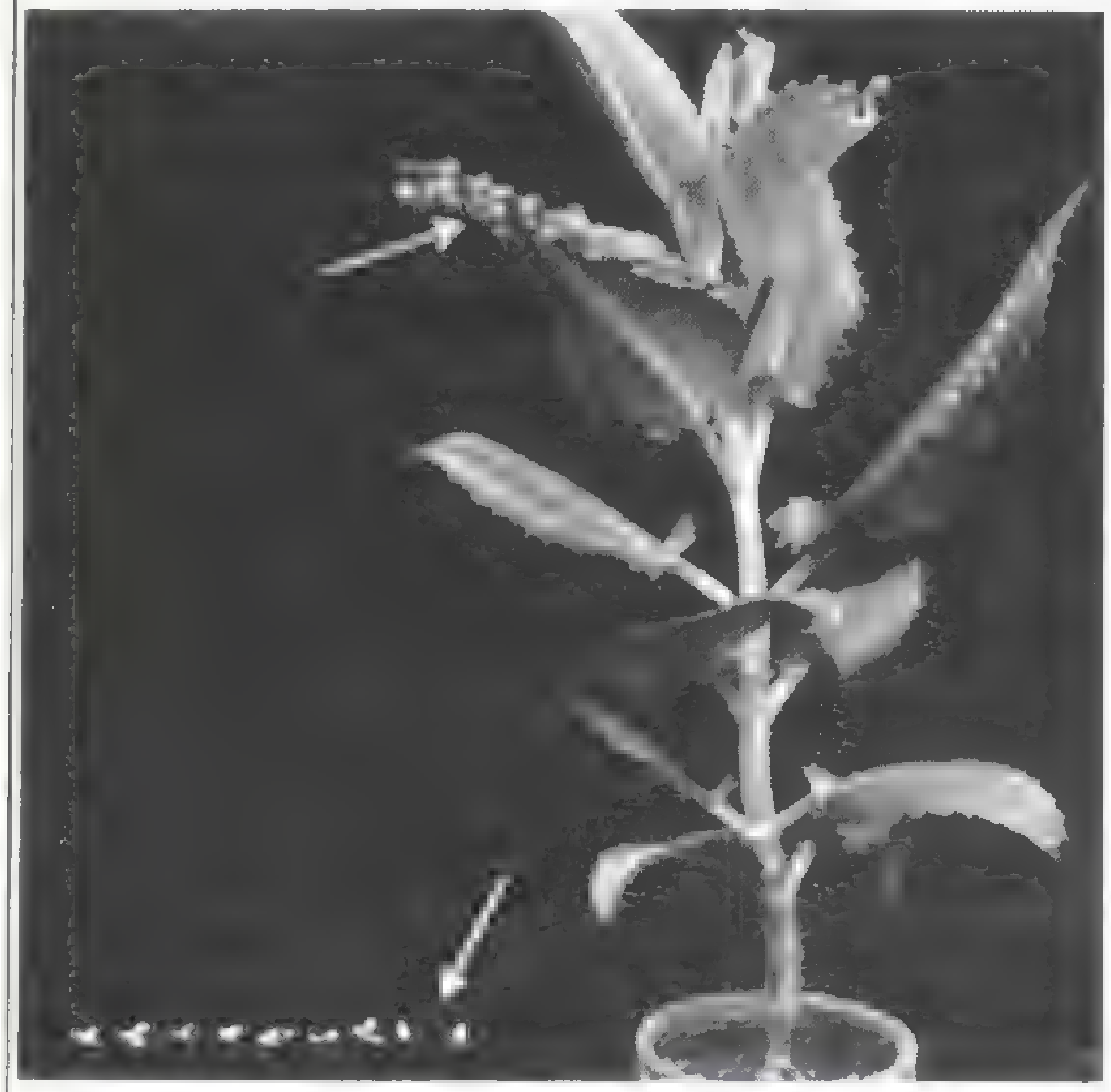
Cuttings.—Plants with thick fleshy leaves and petioles (leaf stems) containing sufficient reserve food can generally be propagated by some form of leaf cutting. An *entire* leaf of bryophyllum placed right side up on moist sand will quickly form a small plantlet at most every notch on the leaf (pl. 26, fig. 3). A



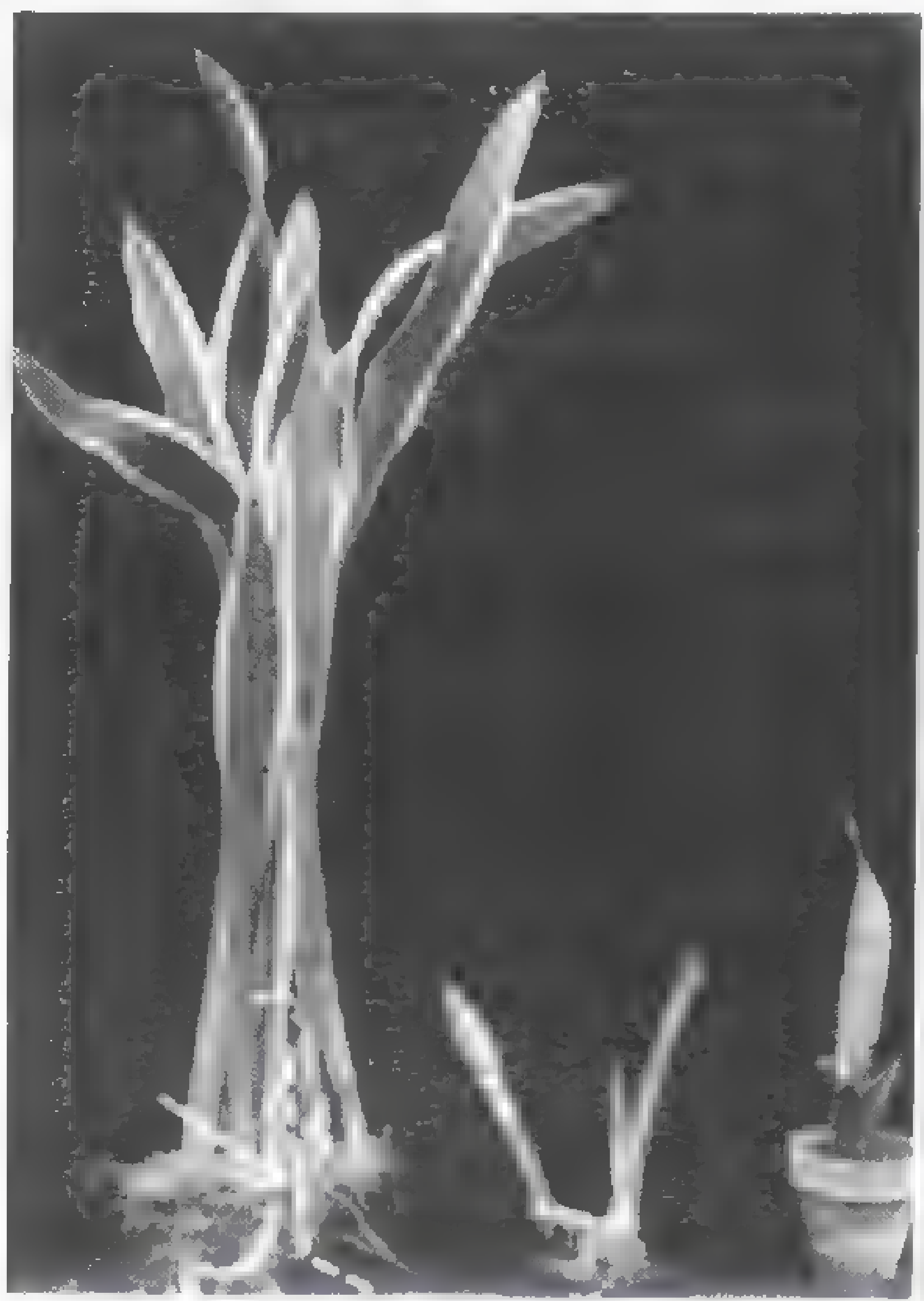
1. LEAF CUTTINGS OF SANSEVIERIA



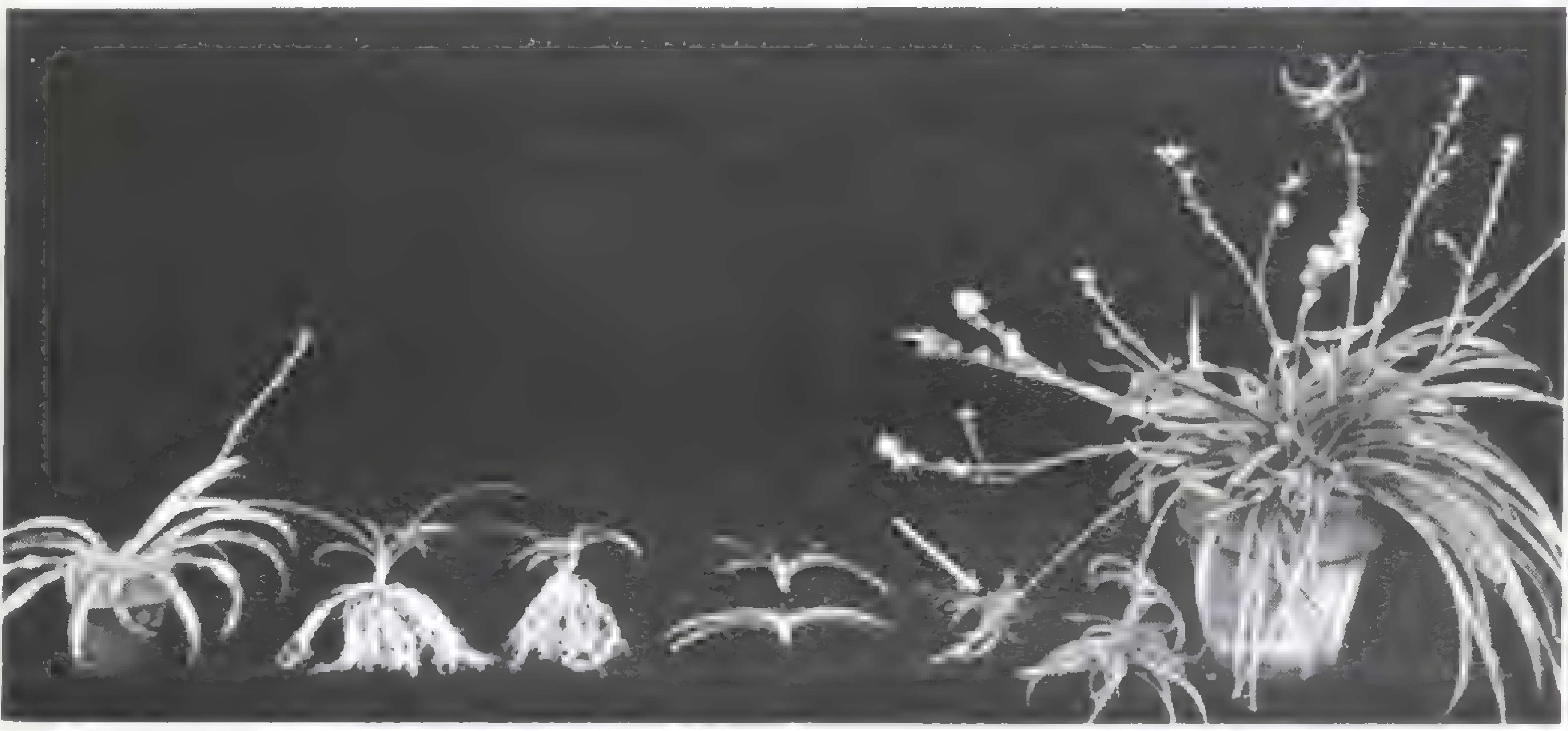
2. GASTERIA LEAF CUTTIN



3. VIVIPAROUS LEAVES OF BRYOPHYLLUM



4. DIVISION OF VARIEGATED SANSEVIERIA



5. OFFSETS OF ANTHERICUM

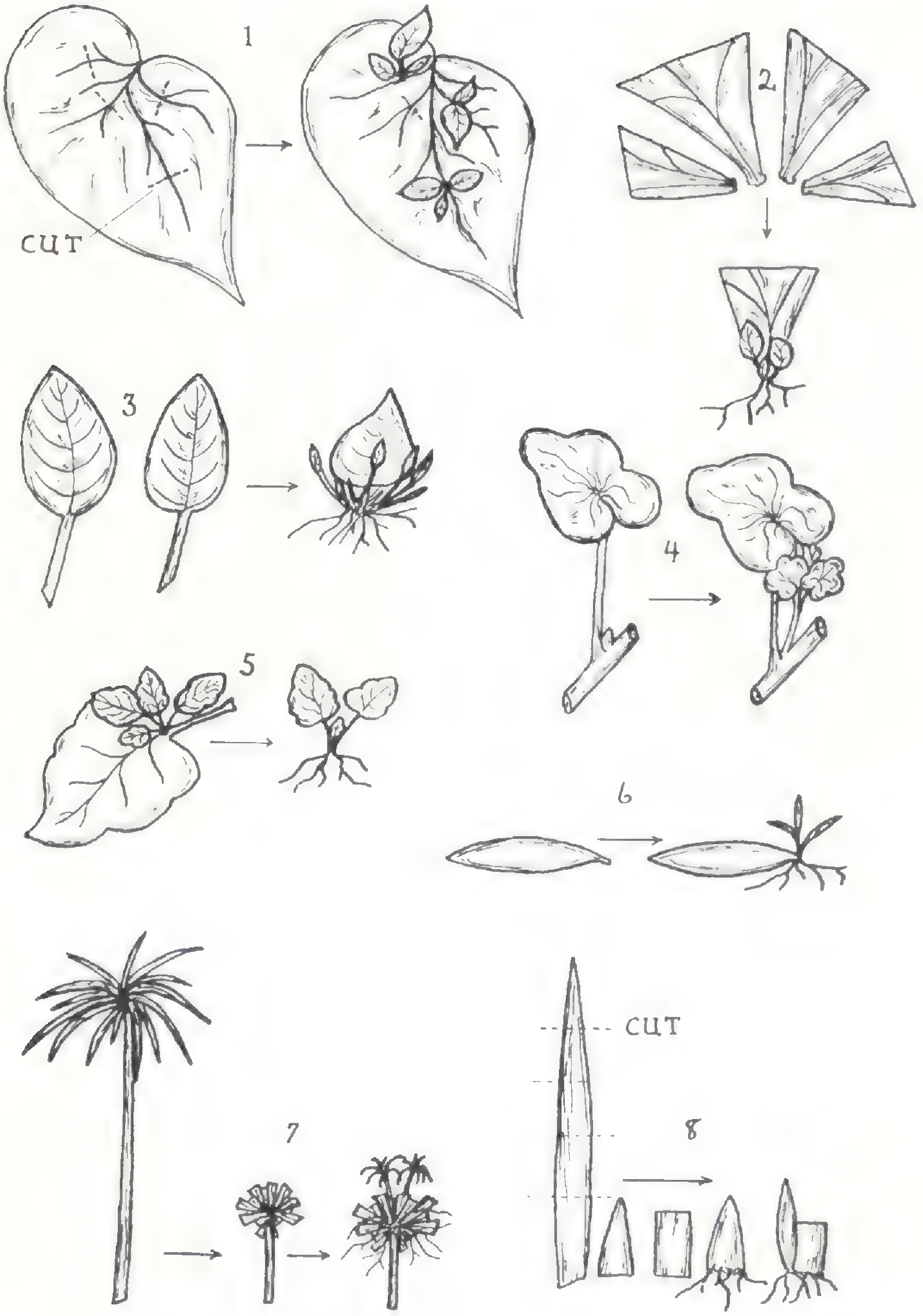
leaf of Rex begonia treated likewise will send forth a number of sprouts from the base of the leaf where all the veins intersect and also from the end of the petiole. Another method is to *sever the veins* of the Rex begonia leaf in various places. When such a leaf is placed in close contact with moist sand and bottom-heat applied, a new plant should arise from each wound (pl. 27, fig. 1). Rex begonias are also reproduced by cutting the leaves into *sections,* each section retaining a portion of the fleshy base of the leaf. If these pieces are placed upright in the sand, new shoots and roots will soon appear (pl. 27, fig. 2). The confined atmosphere of a Wardian case or a bell-jar and slight bottom-heat are essential for success with all leaf cuttings of Rex begonias.

Succulent plants, such as Kalanchoë, Byrnesia, Echeveria, and some sedums, are very easily propagated from leaf cuttings. The fleshy leaves are carefully detached from the parent plant and placed on moist sand. Only the base of the leaf should be covered with sand, the rest of the leaf remaining exposed to the light. The young plant originates from the latent bud at the base of the leaf. When taking the leaves from the parent plant be careful not to wound them, as they are very subject to rot. Avoid excess moisture. These plants are adapted to rather dry conditions, and to keep the sand saturated with water is to invite failure.

The leaves of some plants must have the *petioles attached* in order to strike root (pl. 27, fig. 3). The cuttings are placed vertically in the sand with the petioles buried one or two inches. Young shoots and roots develop from the callus formed on the ends of the petioles. Plants propagated by this method are:

Begonia semperflorens—Everblooming Begonia
Gesneria
Ginkgo—Maidenhair Tree
Gloxinia
Hoya—Wax Plant
Peperomia
Saintpaulia—African Violet
Streptocarpus—Cape Primrose

With *Cyperus alternifolius* (umbrella plant) an entirely different type of propagation is necessary. The stem is cut off a few inches below the head of leaves which is pruned to a convenient length. The cutting is then placed in the sand deep enough to cover the entire head, leaving only the tips of the leaves exposed. Roots and shoots arise from the buds in the axils of the leaves, not from the stem as with most cuttings. When potting up the young plant, remove the old original leaves (pl. 27, fig. 7).



(From Fairburn's *Plant Propagation*)

PROPAGATION BY LEAVES

1. Leaf of Rex begonia with veins cut. 2. Rex begonia leaf cut into sections. 3. Leaf cuttings of African violet. 4. Leaf-bud cutting of geranium. 5. Viviparous leaf of Tolmiea. 6. Leaf cuttings of Byrnesia. 7. Leaf cuttings of Cyperus. 8. Leaf cuttings of Sansevieria.

Another odd type of leaf cutting is that used for propagating Sansevieria (bowstring hemp). The long leathery leaves are cut into pieces several inches in length and the basal ends inserted vertically in the sand, leaving about one-half of the cutting exposed. Roots and shoots develop from adventitious buds formed at the base of the cutting (pl. 26, fig. 1). Avoid excess moisture with these succulent plants. Strangely enough, the yellow variegations of *S. trifasciata* var. *Laurentii* are not transmitted through leaf cuttings. To preserve these variegations the plant must be increased by division of the clump (pl. 26, fig. 4).

A *leaf-bud* cutting includes the leaf, the petiole, the bud in the axil of the leaf, and a portion of the main stem (pl. 27, fig. 4). Roots develop from the "heel" and shoots from the axillary bud. Geraniums, *Begonia semperflorens,* Rhododendrons, Acalypha, and Chrysanthemum are easily reproduced in this manner. It is a good way to get a large increase from a limited amount of stock.

4. Propagation by Division

Plants which form a series of stems from a large crown or those which spread readily by suckers and offsets, making large clumps, are effectively propagated by division (pl. 24, fig. 1). The old plant is dug up or knocked out of the pot and separated into small sections, each having roots and shoots. Plants that make a rampant growth are usually divided every year to keep them in bounds and to avoid crowding. This is especially true with vigorous plants in small rock gardens and flower borders. The following plants need frequent division:

Achillea—Yarrow
Artemisia vulgaris—Mugwort
Aster—hardy types
Boltonia
Campanula—Bellflower
Centaurea Cyanus—Cornflower
Cerastium tomentosum—Snow-in-summer
Ceratostigma plumbaginoides—Blue Leadwort
Chrysanthemum—hardy types
Dianthus—Pink
Doronicum—Leopard's-bane
Euphorbia—Spurge
Helianthus—Sunflower
Oenothera—Evening Primrose
Penstemon—Beardtongue
Phlox—hardy types
Ranunculus—Buttercup
Sedum—Stone crop
Solidago—Goldenrod
Thalictrum—Meadow-rue
Veronica—Speedwell

Division and replanting of most garden material is usually done in early fall so that normal growth proceeds uninterrupted in spring. The following perennials are rather slow growing and are generally divided every three or four years:

Alyssum saxatile—Golden-tuft
Aquilegia—Columbine
Astilbe
Delphinium—Larkspur
Dicentra spectabilis—Bleeding-heart
Echinacea—Coneflower
Hemerocallis—Day-lily
Hosta—Plantain-lily
Iris
Liatris—Blazing Star
Linum—Flax
Phlox

Peonies should be divided about every seven years. Greenhouse plants, such as ferns, orchids, asparagus, violets, etc., are readily increased by division. Shrubs that have a tendency to spread can also be separated when necessary. This is best done in late fall when the plants are dormant.

Of course to appreciate how fascinating plant propagation really is, one has to bolster up a discussion of this sort with actual experience. After these proposed methods have all been tried, there is still another very important subject to consider, namely, grafting, but that is a story all by itself and hardly falls within the scope of the present article.

For several years scientists have been experimenting with special growth-promoting chemicals to stimulate rooting of cuttings, especially the more difficult types. The results of these investigations can be summarized as follows:

1. Soft-wood cuttings that root easily may or may not be benefited by chemical treatment, depending of course on the kind of plant used.

2. Half-ripened or green-wood cuttings of shrubs, vines, etc., sometimes root better with the chemicals, but certain kinds of cuttings give no response with or without.

3. A limited number of hard-wood cuttings respond favorably to the treatment. Some resist all efforts to make them form roots.

So when using these widely publicized root stimulants, it is wise not to think all your troubles are over. Even now there is still much we have to learn.

D. C. F.

NOTES

The University of Illinois Library School, with Miss Rose B. Phelps, of the Faculty, in charge, visited the Garden library, April 11.

Mr. Paul A. Kohl, Floriculturist to the Garden, spoke before the Garden Club of Ladue, April 1, on "Propagation and Division of Perennials."

Dr. Edgar Anderson, Geneticist to the Garden, gave a talk before the genetics seminar at Harvard University, March 24, on "Genetics of Species Crosses."

The April number of *Garden Life* contains comments on *Senecio confusus* and Soil Sterilization by Dr. David C. Fairburn, Horticulturist to the Garden.

Mr. William L. Brown, graduate student at the Garden, has recently received an appointment as Cytogeneticist at the United States Golf Association, Green Section, Washington, D. C.

The January number of *American Midland Naturalist* (**25:** 228-229) contains a review of Julian Huxley's "The New Systematics" by Dr. Edgar Anderson, Geneticist to the Garden.

In the April number of *Garden Forum* (Vol. 3, No. 5) is reprinted the article from the November 1939 *Missouriana* on "Fruit and Berry-bearing Trees," by Mr. L. P. Jensen, Manager of the Garden Arboretum.

"Hedge Plants for St. Louis," an article by Mr. Paul A. Kohl, Floriculturist to the Garden, in the November 1940 BULLETIN, has been reprinted in the April number of *Real Gardening* (**3:** 49-55), under the title "Hedge Plants to Consider."

Mr. George H. Pring, Superintendent of the Garden, was chairman at the tree-planting ceremonies at Northwest Park, April 7, when 150,000 tulip trees were officially presented by Mr. John S. Swift to the school children of St. Louis and the county.

Dr. David C. Fairburn, Horticulturist to the Garden, spoke before the St. Louis Hills Garden Club, April 1, on "Spring Gardening," and before the St. Louis Horticultural Society, April 4, on "New Annuals and Perennials for St. Louis."

Mr. Ladislaus Cutak, in charge of Succulents at the Garden, spoke on "Plants of Old Mexico," March 26, before the elementary botany class of Washington University, and March 31, before the garden section of the Women's Club of Belleville, Illinois.

Mr. Ladislaus Cutak, in charge of Succulents at the Garden, has published two articles recently: "A Flower Hunter in Florida," in the February number of *Desert Plant Life* (**13:** 25-28); and "Cactus Gardening Indoors," in *Lawn and Garden Handbook,* No. 1, pp. 49-51, and 134.

Dr. George T. Moore, Director of the Garden, was interviewed over Station KMOX, March 22, the subject being "There's Sunshine in the Air." On April 3 he spoke before the Ladies' Aid Society of Zion Evangelical Church, on "Mr. Shaw and His Garden," and on April 6, over Station KSD, on "The Case Against Smoke."

Recent visitors to the Garden include: Mr. A. F. Satterthwait, U. S. Department of Agriculture Entomological Laboratory, at Urbana, Ill.; Mr. B. Y. Morrison, Horticulturist in charge of Plant Introduction, U. S. Department of Agriculture, Washington, D. C.; Mrs. Wanda K. Farr, Research Chemist, American Cyanamide Co., Stamford, Conn.; Mr. Walter Adams, Associate Editor, *Better Homes and Gardens,* Des Moines, Ia.; Dr. Earl E. Berkley, Associate Cotton Technologist, U. S. Department of Agriculture, Washington, D. C.

Mr. George H. Pring, Superintendent of the Garden, has given the following talks recently: afternoon of March 12, before the Confederate Memorial Society, on "Spring Planting"; evening of March 12, before the St. Louis Garden Club, on "Breeding of Water-lilies"; March 13, over Radio Station KWK, on "Spring Planting"; March 14, over Station KSD, "A Preview of the St. Louis Flower Show"; March 15, over Station KMOX, interview with Prof. Quiz, on "The St. Louis Flower Show"; March 16, over Station KSD, "The Flower Show," as part of "In St. Louis This Week" program; April 1, Greater St. Louis Association of Gardeners, "Breeding Water-lilies."

STATISTICAL INFORMATION FOR MARCH, 1941

GARDEN ATTENDANCE:	
Total number of visitors	16,063
PLANT ACCESSIONS:	
Total number of plants and seed packets received as gifts	1,036
LIBRARY ACCESSIONS:	
Total number of books bought	13
Total number of books and pamphlets donated	179
HERBARIUM ACCESSIONS:	
By Bequest—	
Private herbarium of the late Prof. J. Andrew Drushel, estimated at	10,000
By Purchase—	
Heller, A. A.—Plants of California	475
By Gift—	
Atkins Institute of the Arnold Arboretum, Harvard University, by F. G. Walsingham—*Agave Brittoniana* Trel. from Cuba	2
Demaree, Delzie—Plants of Arkansas	34
Heller, A. A.—Plants of California	2
Hubricht, Leslie—Lichens of Missouri	8
Kiener, Walter—Lichens of Costa Rica	9
Martinez, Maximino—*Fagus mexicana* Martinez from Mexico	5
Murphy, Mrs. Gilbert—*Cornus Mas* L. from horticulture	1
Von Schrenk, Hermann—Plants of Texas	5
By Exchange—	
California Academy of Sciences—Plants of Western United States and of the Galapagos Islands	58
Gray Herbarium, Harvard University—Cent. XI "Plantae Exsiccatae Grayanae"	100
Gray Herbarium, Harvard University—Miscellaneous duplicates	92
U. S. National Museum—Plants of Mexico and Central America	44
By Transfer—	
Fairburn, D. C.—*Pelargonium roseum* Willd. from horticulture	1
	10,836

SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date to the death of Mr. Shaw, in 1889, the Garden was maintained under the personal direction of its founder, and while virtually a private garden it was, except at certain stated times, always open to the public. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was designated by Mr. Shaw as its official title and in his will and all of his writings he specifically referred to it as the "Missouri Botanical Garden." By a provision of Mr. Shaw's will the Garden passed at his death into the hands of a Board of Trustees. The original members of the Board were designated in the will, and the Board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provison of the will, the immediate direction of the Garden is vested in a Director, appointed by the Board of Trustees. The Garden receives no income from city or state, but is supported entirely from funds left by the founder.

The city Garden comprises 75 acres, where about 12,000 species of plants are growing. There is now in process of development a tract of land of over 1,600 acres outside the city limits which is to be devoted to (1) the propagation and growing of plants, trees, and shrubs, designed for showing either indoors or outside, at the city Garden, thus avoiding the existing difficulties of growing plants in the city atmosphere; (2) gradually establishing an arboretum as well as holding a certain area as a wild-flower reservation, with the idea that possibly at some future time this may become the new botanical garden.

The Garden is open to the public every day in the year except New Year's Day and Christmas—week days from 8:00 a. m. until sunset; Sundays from 10:00 a. m. until sunset. The greenhouses are closed every day at 5:00 p. m.

The main entrance to the Garden is located at Tower Grove Avenue and Flora Place, on the Sarah car line (No. 42). Transfer south from all intersecting lines.

STAFF
OF THE MISSOURI BOTANICAL GARDEN

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Pathologist

Jesse M. Greenman,
Curator of Herbarium

Carroll W. Dodge,
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Edgar Anderson,
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Ladislaus Cutak,
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Manager

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Engineer

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"A book that is complete. . . . Undoubtedly the book Missouri flower-lovers have been looking for."

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Field Museum Notes

For sale by the Missouri Botanical Garden. Price $3.00

MISSOURI BOTANICAL GARDEN BULLETIN

Vol. XXIX MAY, 1941 No. 5

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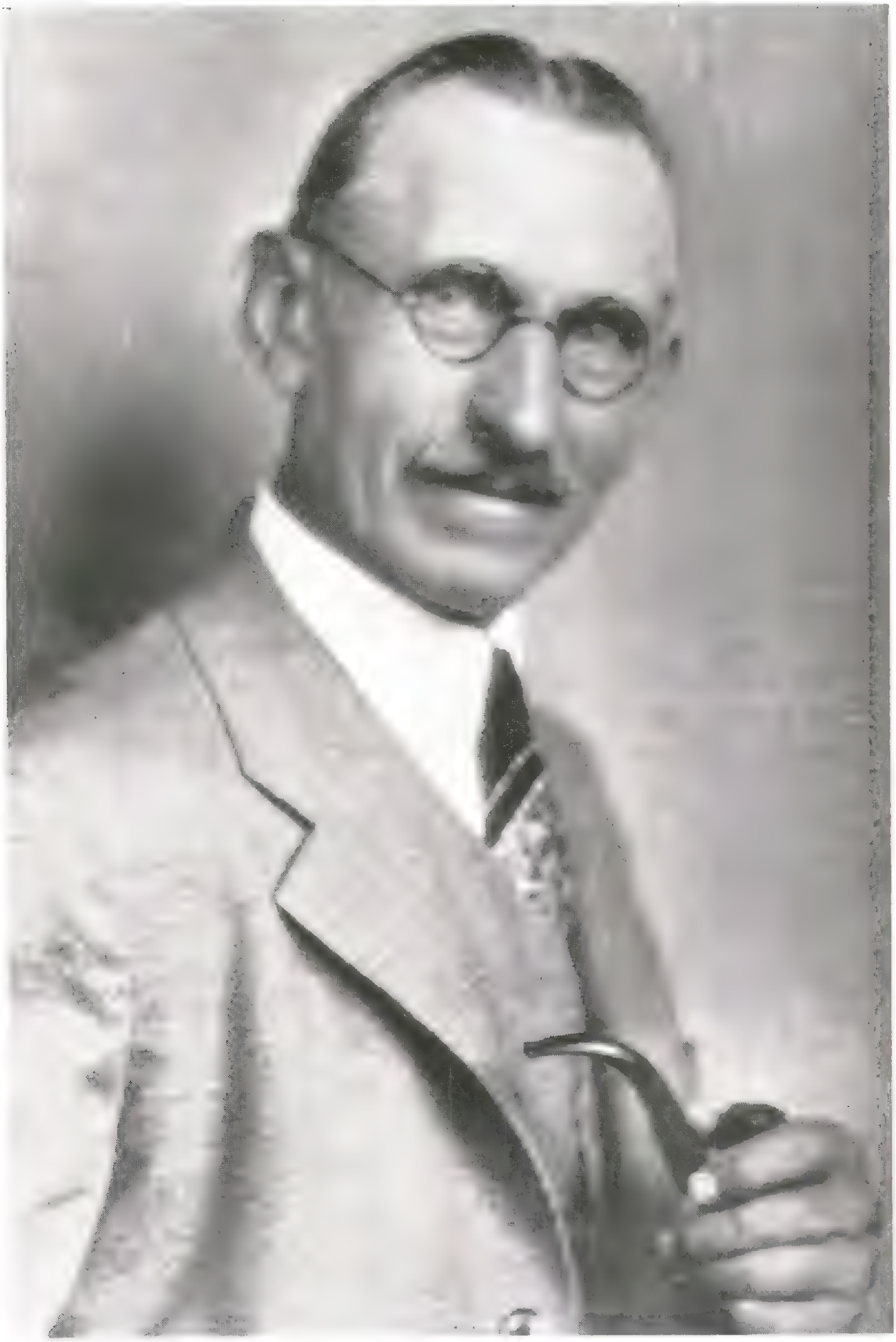


LARS PETER JENSEN

1867 1941

(?)

Missouri Botanical
Garden Bulletin

Vol. XXIX MAY, 1941 No. 5

LARS PETER JENSEN

(?)1867 - 1941

Born
May 11, 1869
Vindige, Denmark.

Lars Peter Jensen, or "Pete," as he was affectionately known to his associates, was first connected with the Missouri Botanical Garden in 1920, when he became Arboriculturist to the city Garden. Four years later he went into the florist business with his son, but in October, 1926, he returned to the Garden to take charge of the new development known at that time as the "Gray Summit Extension." By January, 1932, the "extension" had progressed to a point where it could be dignified by the term "arboretum," and Mr. Jensen became the first resident manager of the Missouri Botanical Garden Arboretum, which position he held to the time of his death on April 23.

The horticultural profession, of which he was a loved and respected member, will miss him to an unusual degree, for he was actively associated with the leaders in this field. But it is his friends locally who will feel his absence most acutely, for he was much more to the flower lovers of Missouri than a mere manager of an arboretum. Perhaps the impersonal estimate by a newspaper will best summarize the place filled by Mr. Jensen in his services to the plants and people with which he lived.

The following excerpts from an editorial appeared in the *St. Louis Globe-Democrat*, April 25, 1941:

A GREAT HORTICULTURIST

> It was fitting that the first blossoms should start to show along United States Highway 66 to Gray Summit this last fortnight before Lars Peter Jensen died in Barnes Hospital, because Mr. Jensen was a chief lover and protector of blossoms and flowers.

He organized garden clubs; he preached flower conservation; he was president of the Henry Shaw Gardenway Association, which sponsored the banks of flowers and shrubs along United States Highway 66 from the city limits to Gray Summit.

The native flowers of Missouri seemed closest to his heart. He liked to show a cluster of prairie roses or a single white evening primrose. He was once asked: What is the most beautiful Missouri flower? This was his answer:

"That is a hard question. A combination of wild plum and redbud on a hillside or a knoll covered with blue sweet williams would be inspiration for any poet. Bird's foot violets on a glade are a lovely picture. And purple cone flower intermingled with Missouri primrose and coreopsis gives splendid mass color."

Jensen's Point, an observation tower atop a 100-foot cliff beside the highway at Pacific, was named in Mr. Jensen's honor while he was alive. But every Missourian who appreciates and protects a Missouri flower is also doing him honor.

Mr. Jensen at the "Gray Summit Extension," when he first took charge.

Nothing could so completely express the feeling Jensen had for nature or his overwhelming desire for the sensible preservation and conservation of all that contributes to the "native beauties of our land" as his own words. The verses were written by Mr. Jensen some years ago for the St. Louis Wild Flower Club:

LEND A HAND

Come, my friend, reach out a helping hand,
To save the native beauties of our land.
Break not the bough which blossoms fair,
Nor strip the woodlands altogether bare,
Help us to plant, and not destroy
The beauties others should enjoy,
Let us pass by, and leave behind,
A part of each, of every kind
Of scenery fair, and birds in air,
Of fish in streams, and blossoms fair,
So that the ones who come our ways
In some distant future days,
May say that we have guarded well
The treasures among which they dwell.

The beauties of our charming land
We are wasting with a lavish hand;
Perhaps, because we cannot see
That to such abundance, an end could be,
Or, perhaps, our earthly selfish greed
Makes us forget what others need,
And blinds us so we cannot see
Our duty to posterity.
Therefore, my friend, let's not debate,
But lend a hand, it's not too late
To educate, to preach and teach,
In every hamlet we can reach,
To save, to hold, to add, and give
What others must enjoy to live.

AZALEAS FOR ST. LOUIS AND VICINITY

About eight years ago an extensive planting of deciduous Azaleas was started at the Garden. This was the first planting in many years. Before then almost no azaleas and only a few well-established Rhododendrons were growing in the gardens around St. Louis. No one had been very successful with either of these plants. The feeling that something could be done was strengthened by the fact that very old specimens of Azaleas were still alive in the Garden and that several more were known to be growing in parts of the city and suburbs.

It has always been assumed that Rhododendrons and Azaleas could be grown only in partial shade, yet the three veterans at the Garden were growing in dense shade. Since these plants had existed in this bed for some thirty years, it was decided that here was the logical place to plant more specimens.

Preparation of Site.—The preparation of the bed is probably the most important single factor in the growing of Azaleas. In the plantation at the Garden all the soil to a depth of two feet was spaded up, and in the process six bales of peat were worked in. The Azaleas were then set about thirty inches apart. After the first summer, during which some irrigation was necessary, it has become customary to rake onto this planting all the leaves within reach. In some years an especial effort was made to gather only oak leaves. In other seasons any and all kinds of leaves were added. Along with the annual fall mulch of leaves all the used orchid peat, which is quite coarse, has been added whenever available. The present mulch, built up over a period of eight years, presents a thoroughly efficient soil cover, preventing evaporation and furnishing a dependable source of food for the plants through slow decomposition.

Rhododendron (Azalea) nudiflorum, a native Missouri species grown at the city Garden in full sun.

AN AZALEA SUCCESSFULLY GROWN IN ST. LOUIS FOR TWENTY-FIVE YEARS

AZALEAS AT ARBORETUM, SOUTH EXPOSURE

AZALEAS AT ARBORETUM, EAST EXPOSURE

Two years before the planting at the city Garden, Azaleas had been started at the Arboretum. Here also a partly shaded site was chosen, this time under a large group of mature Oak trees. There was little preliminary preparation of the soil, but immense quantities of leaves were placed about the plants periodically. For several years the Azaleas made good growth but never equalled those in town. Finally, a succession of very dry years, during which the deeper-rooted trees used all available water, caused much injury. In 1940 this plantation was watered at regular intervals with a tank truck, as much as 16,000 gallons being applied at a time. Even at that the plants looked bright and fresh for only three or four days after being watered. Obviously, Azaleas should not be planted under large trees, but they were supposed to require some shade. During the time that this large plantation was declining, another much smaller one was attempted as an experiment in the most exposed location in the Pinetum. This bed received no preparation, the plants being placed in holes dug in the turf. However, a very generous dressing of sawdust was applied annually, until now it is over ten inches deep. It might be said that this group is wholly without shelter from the sun, and is protected only on the north and west by a group of Pines. During the summer of 1940 only 1000 gallons of water was supplied, but without the competition of large trees this was ample since the very heavy mulch prevented evaporation. It is this group which has produced a floral display and from which quantities of viable seed have been harvested.

Site and Shelter.—So successful was this experimental planting that a much more ambitious one was started in December, 1940. Our experience with these earlier plantations having indicated that Azaleas might stand a better chance if they were placed in full sun, the new bed was located about 200 feet from large trees, on a slope facing north and east. However, the forest and evergreen group plantings on the south and west act as very effective windbreaks and should prevent the injury which inevitably follows our midsummer winds. The preparation of this bed is especially interesting since we believe that it represents a summation of our experience on Azalea culture.

Preparation of New Bed.—The whole area was plowed in December, 1940, to a depth of ten inches, using a heavy tractor and two-bottom plow. It was left in this rough condition until February, when eight loads of rotted Oak sawdust were broadcast to a depth of two inches. To this were added three loads of orchid peat and finally one load of cow manure. In March, after some rain, the whole bed was then tilled with a tractor-powered Seaman Tiller—a tool very much like the Roto Tiller except for size. After two complete trips over the bed, each of which overlapped the previous one, the soil was so friable that one could plunge a hand into it to a depth of twelve inches. The rather strange forms of humus were now so well incorporated into the soil that it became impossible to distinguish them. One might easily wax enthusiastic over this type of soil preparation. After the plants were set out in April an additional 75 cubic yards of sawdust were broadcast as a mulch.

Dependable Types of Azaleas.—Before discussing the actual types a word will have to be said about their classification. Botanists originally thought that these plants and their close relatives could be divided into two separate genera, and they gave names to the two general sorts which have passed into common speech, Azalea and Rhododendron. The Azaleas were mostly deciduous and had flowers delicate in texture, while the Rhododendrons were prevailingly evergreen with somewhat waxier flowers. When collections poured in from western Asia these distinctions could no longer be maintained. There were Azaleas which looked like Rhododendrons and Rhododendrons which looked like Azaleas and various missing links which looked like both—or neither! The name Azalea therefore had to be abandoned as a scientific name, though it is still kept up by gardeners and in some nursery catalogues. In the following list the name Rhododendron merely indicates that we are following botanical practice in classifying these Azaleas in the genus Rhododendron. It does not mean that they are giant shrubs with big evergreen leaves.

"Mollis Hybrids."—These represent various hybrids with the Japanese Azalea, *Rhododendron japonicum.* The name comes from the fact that the Chinese Azalea, *Rhododendron molle,* was one of the species used in making the original crosses. The Japanese Azalea is splendidly suited to our conditions since it is more tolerant of limey soil and of dry summers. When it can be obtained it is preferable to the hybrids. Out of an original mixed lot grown at Gray Summit all of the superior plants which have survived are pure *Rhododendron japonicum,* and show no influence of the yellow Chinese Azalea, *Rhododendron molle,* or of the Ghent Hybrid Azaleas which were once introduced into the "Mollis Hybrids."

Rhododendron roseum.—This native American species has been extensively confused with *Rhododendron nudiflorum,* to which it is closely related but to which it is inferior as a garden plant. By most nurserymen it is listed under that name or as *Azalea nudiflora.*

Several other species are being grown successfully but they are more difficult to keep in good condition. The ones which are being grown and the most serious objections to each are as follows:

Rhododendron mucronatum (often listed as *Azalea indica alba*).—This is a large white Azalea with leaves which are nearly evergreen in this climate. It should not be confused with the Mongolian Azalea, *Rhododendron mucronulatum,* a picturesque shrub with rosy magenta flowers which open even earlier than the Forsythias. The leaves of *R. mucronatum* are often browned badly enough to be unsightly at flowering time.

Rhododendron yedoense and its variety *poukhanense* have the same behavior and culture as the above.

Rhododendron obtusum var. *amoenum.*—A low, very floriferous plant which requires some shade. It is also evergreen.

Culture.—After the initial preparation of the soil, the subsequent culture is not very difficult. Top dressings of ammonium-sulphate and complete fertilizers both have been used, being broadcast at the rate of one pound per fifty square feet of growing space. However, they are needed only when the growth rate is not satisfactory, which may occur before a heavy leaf mulch has been built up. Aluminum sulphate has been used to maintain a pH point of 6 to 6.5, but there is not much need to check to degree of acidity, especially after a bed is established. No doubt in regions of very alkaline soils it will be necessary to control the pH point, but as a general rule it is not important in this area. In our experience the one "must" in the culture of Azaleas is the use of leaf mold and more leaf mold. However, after a mulch has been built up, very little attention is needed; weeds will not grow through a very deep layer of decomposing leaves, and what water is applied soon drains into the lower levels, leaving the top too dry and loose for weed germination. Leaves are not the only material which may be used as a mulch. At the Arboretum it is easier to obtain partly rotted—or even fresh—Oak sawdust, and the results are equally as satisfactory as the leaves. The best bed at the Arboretum has a six-inch mulch of sawdust. In regard to irrigation, it is necessary to supply water only when the plants show signs of distress during the middle of summer. A word of caution, however, about the kind of water—ordinary city tap water, as well as most deep well water in the county, contains much lime, so it is best not to use it unless absolutely necessary. All irrigation water at the Arboretum is from either lakes or cistern, while in St. Louis the Azaleas are irrigated through a special pipe and pumping system using water from a lake in the North American tract. Another good argument for the use of a mulch is that there is less need to irrigate.

After the original deep spading of the bed, no additional spading should be done. Azalea roots are not deep, but rather spread within the upper foot or so of soil, and in time grow in the mulch itself. Therefore spading, if not done very carefully, may do much harm. However, if the original preparation was not thorough enough, one can spade under the mulch between the plants and immediately add a new layer of leaves. Such work is best done in early fall, just as the leaves are being shed.

A. P. B.

PROPAGATION

The propagation of Azaleas should not be a difficult matter for anyone who possesses a fair amount of patience and a willingness to provide the young plants with favorable growing conditions. If these prerequisites appear too exacting, perhaps it would be wise to ignore what follows and devote more time to the culture of castor beans.

Azaleas are propagated by seed and vegetative methods such as cuttings, layering and division. Certain kinds respond readily to several methods of increase, whereas others are definitely temperamental and must be treated accordingly. But, regardless of how Azaleas are propagated, they are a slow-growing group of plants, a fact which may justify the retail prices of mature specimens. To offset the initial expense of gardening with Azaleas, try raising your own plants.

Seed.—This is the most effective method for amateur gardeners to build up a generous collection of vigorous young plants. Of course, seed from such types as the "Mollis Hybrids" (crosses with *Rhododendron japonicum*—see p. 134) produce plants that may have considerable variation in color and quality, but by hand-pollinating the flowers and saving seed from only the best parent plants, the percentage of inferior seedlings can be materially reduced. If necessary, seed can be purchased.

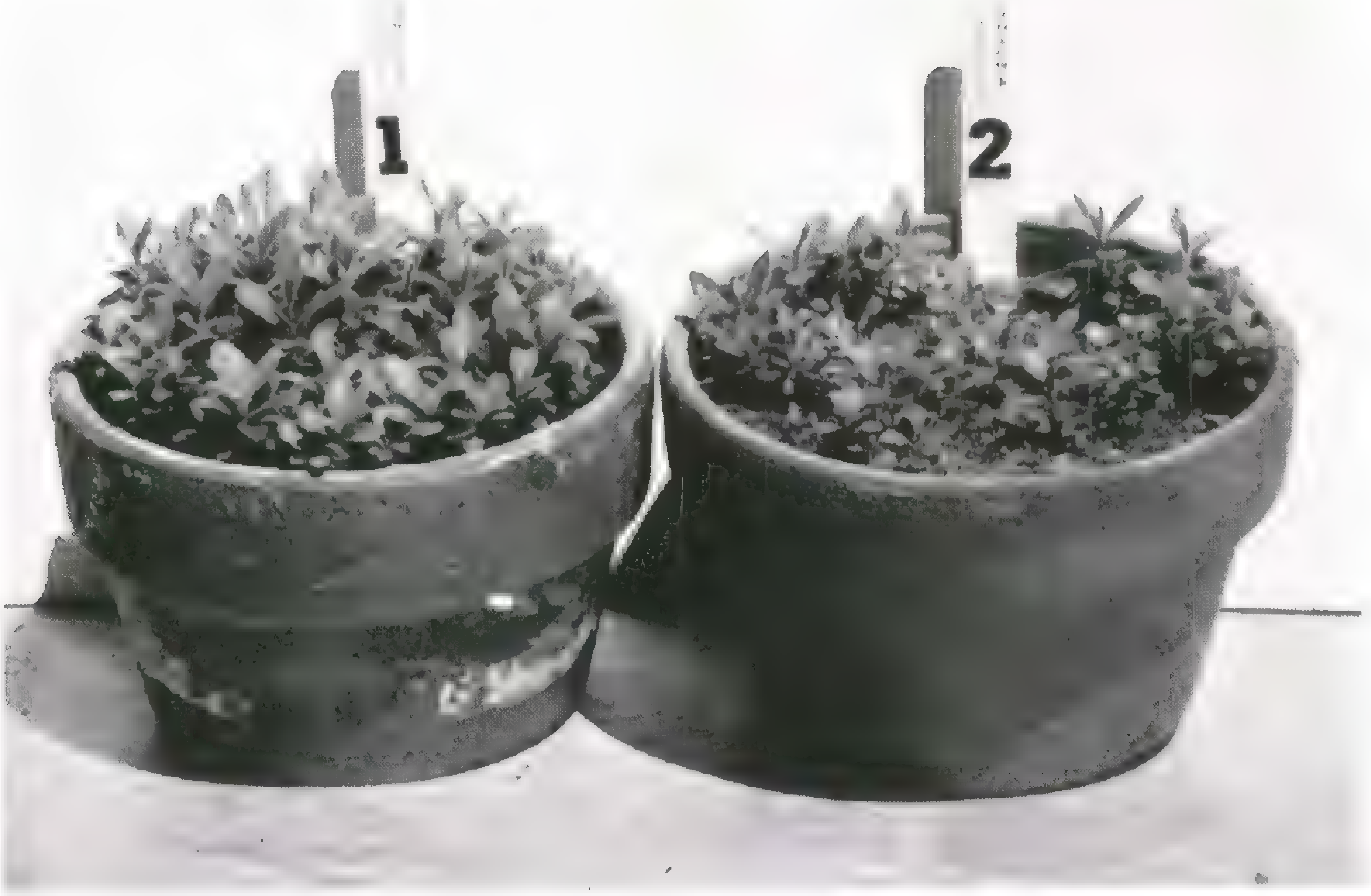
For best results the seed must be fresh. We have had excellent germination from seed planted in the greenhouse soon after it ripened in September and October, but when it is stored for two or more years viability becomes doubtful. Experiments at the Garden have also shown that seed germinates readily in various combinations of soil, sand and peat, and that a mixture of equal parts of sand and acid peat seems to top the list by a wide margin (pl. 31, fig. 1). Undoubtedly, the acidity of the peat stimulates germination and growth of the seedlings for it is well known that Azaleas prefer an acid soil reaction. We have been using imported peat, but there is every reason to believe that any of the peats produced in this country would do just as well provided they are acid or could be made acid in reaction.

The seeds may be sown in regular flower pots, bulb pans, small flats (shallow wooden boxes), or similar containers that have ample drainage facilities. The various steps in sowing seed in bulb pans are as follows:

1. Place a handful of broken pottery in the bottom of the pan for drainage.

2. Fill the pan with moist sand-peat mixture, and tamp it down firmly to ½ inch below rim of the pan.

3. Sow the seed broadcast on the surface. Azalea seeds are small, therefore be careful not to plant them too thickly. An 8-inch bulb pan will accommodate 250 to 300 seedlings up until the time they are ready for transplanting. If germination exceeds expectations, pull out some of the seedlings to avoid crowding.



1

Comparative growth of Azalea "Mollis Hybrid" seedlings in sand-peat (left) and soil (right).

2

Seedlings of Azalea "Mollis Hybrids" three months old, ready for transplanting to individual two-inch pots.

4. Sprinkle a very light covering of sand-peat over the seeds.
5. Moisten the surface carefully, using a fine spray, or place the pan in a tray of water so that moisture penetrates the sand-peat without disturbing the seeds.
6. Cover the pan with a piece of window-glass to conserve moisture until germination starts. Prop up the glass cover with a pencil or something, as a certain amount of ventilation is necessary. If exposed to direct sunlight, shade with newspaper or cheese-cloth to avoid over-heating.

Amateur gardeners who do not have a greenhouse or conservatory can place the seed pans on a sunny window-sill. If desired, the seeds may be stored in a cool, dry room during winter and planted outdoors in spring, using the same methods as recommended for indoor planting.

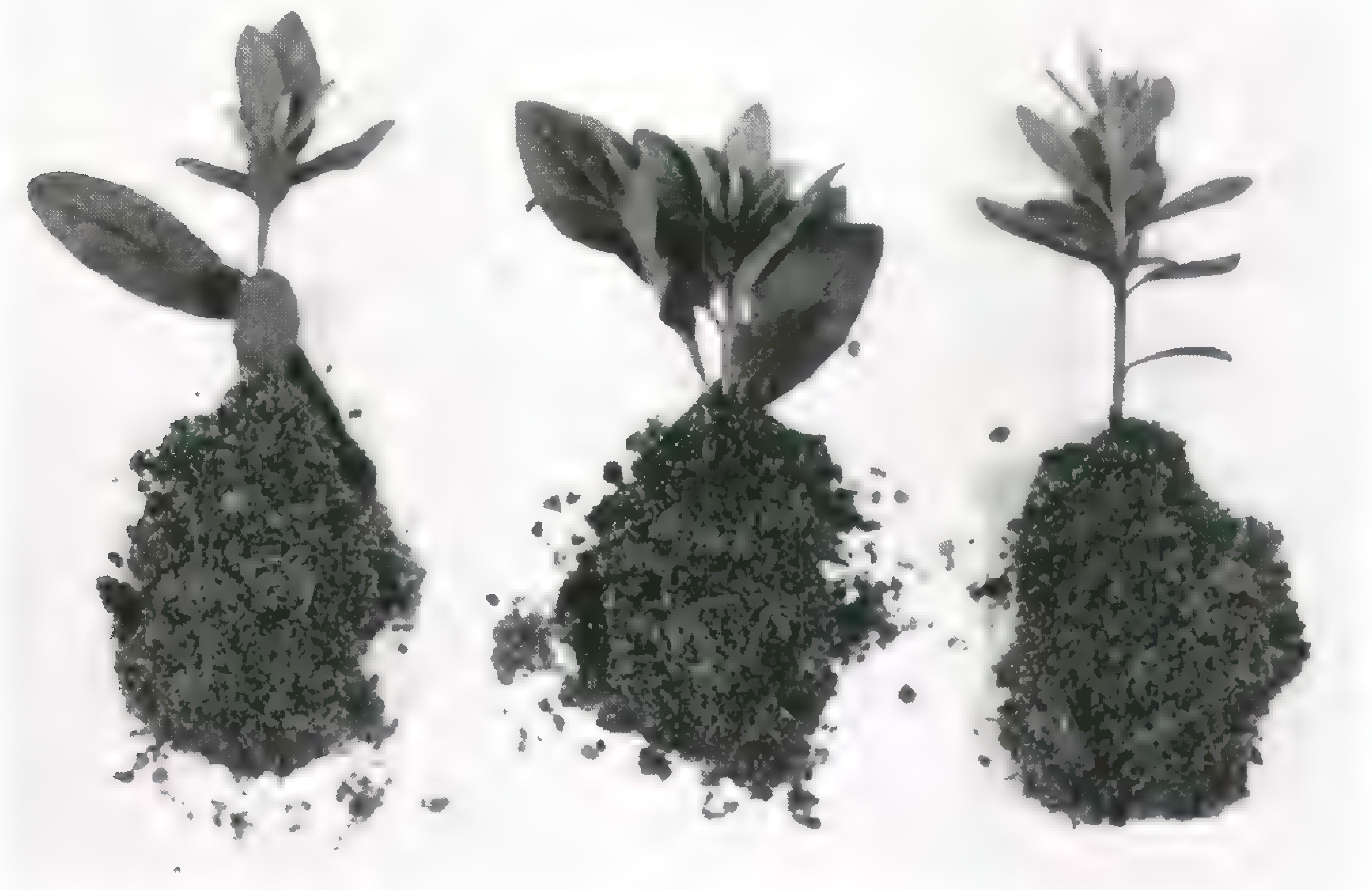
The seeds should never suffer from lack of moisture during the germination period, which is about two weeks. Given a fairly cool temperature (60°-70° F.), abundant water, full sunlight (with partial shade in summer) and an occasional fertilizing with weak liquid cattle manure, the young seedlings grow vigorously and are ready for transplanting to individual two-inch pots three months from the date of seeding (pl. 31, fig. 2). In spring the potted plants can be transferred to a cold-frame and protected from strong sunlight by a lath shade. Until the seedlings are about two years old, they should be wintered over in the greenhouse or a well-protected cold-frame. If the young plants are handled properly, they will be large enough in three to five years to set out in the nursery or shrub border.

Cuttings.—Many Azaleas can be propagated successfully from green wood cuttings taken from the plants in late June, July and August, after the wood of the current year's growth has become firm. Regular tip cuttings, with or without a heel, may be used. The most satisfactory rooting medium is a mixture composed of one part sand and one part acid peat. During summer the best place to root the cuttings is in a partly shaded cold-frame (pl. 32, fig. 1). Cuttings taken in September can be rooted in the greenhouse, using the sand-peat mixture and a glass-enclosed frame (Wardian Case).

The cuttings require six to eight weeks to form a good root system (pl. 32, fig. 2); then they are carefully transferred to indi-

1

Green wood cuttings of *Rhododendron (Azalea) mucronatum* root well in a partly shaded cold-frame during summer.



2

Cuttings of *Rhododendron (Azalea) mucronatum* removed from the cold-frame to show well-developed root system after eight weeks in the sand-peat mixture.

vidual pots and handled in the same way as seedling plants. Certain kinds of Azaleas, such as the "Mollis hybrids" and *Rhododendron (Azalea) nudiflorum,* do not propagate easily from cuttings. We have tried all sorts of chemical treatments, but so far the results have not been very encouraging. Fortunately, there are other ways to propagate these kinds.

Experiments with hard or dormant wood cuttings taken in late fall and stored outdoors in sand, peat and soil over winter have not yielded satisfactory results. They form calluses but root development is poor.

Layering.—Azaleas that are difficult to propagate by cuttings often respond well to layering. Of course to do this, the ornamental value of the plant has to be sacrificed for the duration. The process consists of cutting back the top rather severely in summer to force new growth at the base. When these new shoots are well started, a mixture of sand and peat is mounded up, or boxed in, around them. A short cut, made partly through the basal joint of each shoot, may stimulate root formation. In two or three years these shoots generally develop independent root systems and can be separated from the parent plant.

Another form of layering is easily accomplished in summer by bending down a low-growing branch, pegging it to the soil with a wire loop and covering all but the tip end with the sand-peat mixture. The rooting mixture should always be moist. Any type of layering requires two or more years for satisfactory results.

Division.—Some Azaleas have a tendency to send up a number of shoots from a spreading root system. It is a simple matter to cut off these shoots, along with a generous portion of root, and transplant them as independent plants. This process is best done in spring.

Grafting.—In order to speed up maturity and retain the desirable characters of certain hybrid Azaleas such as the "Ghent," "Mollis" and "Indian," nurserymen have found grafting essential. Scions or twigs of the Azaleas are grafted on seedling stocks of such species as *Rhododendron (Azalea) molle, R. (Azalea) japonicum* and *R. (Azalea) mucronatum.* Grafting operations usually start in fall and continue throughout winter in the greenhouse. Amateurs who may wish to try propagating Azaleas in this manner had better spend considerable time reading special literature on the subject and then visit some nursery to see the job actually done.

D. C. F.

NOTES

Mr. Paul A. Kohl, Floriculturist to the Garden, gave an illustrated lecture on "Roses" before the Northwoods Garden Club, May 5.

The April 10 and April 17 numbers of *Southern Florist & Nurseryman* contain a reprint of Mr. Pring's article on "Tropical Water-lilies" from the March, 1941, Garden Bulletin.

Dr. George T. Moore, Director of the Garden, spoke before the Kansas City Garden Club, May 5, on "Henry Shaw and His Garden." The talk was illustrated with colored motion-pictures.

The annual flower sermon, provided for in Henry Shaw's will, was preached at Christ Church Cathedral, on April 27, by Dr. Rufus M. Jones, of Haverford, Pa., emeritus professor of philosophy, Haverford College.

Mr. Ladislaus Cutak, in Charge of Succulents at the Garden, gave an illustrated lecture, "Gardens of Florida," before the Garden Section of the Woman's Club of Nashville, Ill., afternoon of May 6; and on "Plants of Old Mexico," before the St. Louis Hills Garden Club, evening of May 6.

Mr. George H. Pring, Superintendent of the Garden, conducted the "Plant Clinic" of the Garden Club of Washington, Mo., on April 10. On April 22 he gave a talk, illustrated with moving pictures, before the Girls' Friendly Society of St. Peter's Church, on "The Garden in Bloom Throughout the Year."

Mr. Ladislaus Cutak has an article "Soapweed, Spanish Bayonet, or Adam's Needle," in the April *Garden Gossip* (**16**:12-23). He has also written the "Foreword" to the recently published Cactus Catalog Guide of the Irwin M. Krohn Conservatory, Eden Park, Cincinnati, Ohio.

The second number of volume XXVIII of the Annals of the Missouri Botanical Garden, issued in April, contains the following papers: "Binary Variation in *Tradescantia bracteata,*" by

Edgar Anderson; "On the Flora of the Frontier Formation of Southwestern Wyoming," by Henry N. Andrews and Cortland S. Pearsall; "The North American Asclepiadaceae. I. Perspective of the Genera," by Robert E. Woodson, Jr.; "Two New Asclepiads from the Southwestern United States," by Bassett Maguire and Robert E. Woodson, Jr.

The annual tour of gardens in the vicinity of St. Louis, sponsored by the St. Louis Garden Club for the benefit of the Missouri Botanical Gardens, and for educational purposes, was conducted in two sections this spring—early and late gardens. The tour of early gardens took place on April 26-27, but garden enthusiasts still have the opportunity, on May 24 and 25, to visit the late gardens. The fee of one dollar includes admission to all the gardens, and for one dollar extra the inside of the historic house of Mr. and Mrs. William O. Schock may be seen. Tickets are on sale at the Missouri Botanical Garden and at all gardens when open. Following is a list of the late gardens:

Mr. Frank Hammar, Lemay Ferry Road to Pevely, turn left to river, follow black arrow.

Mr. and Mrs. Wm. O. Schock, "Selma Hall"—south on 61 or 67 to 1 mile south of Festus; turn left on 25, 3½ miles; turn left at red brick house, ⅜ mile, to west gate of Selma property.

Mr. and Mrs. Hayward Niedringhaus, 7 Sunningdale Drive, St. Louis Country Club Grounds.

Mr. and Mrs. Orion J. Willis, 2 St. Andrews Drive, St. Louis Country Club Grounds.

Mr. and Mrs. Joseph L. Werner, 9625 Ladue Road.

Mr. and Mrs. Arthur C. Hiemenz, 1 Ladue Lane.

Mr. and Mrs. I. A. Stevens, Clayton and Conway Roads.

Mr. and Mrs. O. K. Bovard, Conway and Ballas Roads.

Recent visitors to the Garden include: Mr. Andrews Denny Rodgers III, of Columbus, Ohio, author of *"Noble Fellow," the Biography of William Starling Sullivant;* Mr. H. L. Westover, Principal Agronomist, Division of Forage Crops, U. S. Department of Agriculture, Washington, D. C.; Dr. Julian F. Smith, Associate Director, Hooker Scientific Library, Central College, Fayette, Mo.; Dr. Harry J. Fuller, Assistant Professor of Botany, Dr. F. Lyle Wynd, Assistant Professor of Botany, and Mr. William C. Leavenworth, Assistant in Botany, all of the University of Illinois; Dr. George W. Corner, Director, Department of Embryology, Carnegie Institution of Washington, Baltimore, Md.; Dr. W. O. Richtmann, Professor of Pharmacy, University of Wisconsin, Madison, Wis.; Mr. D. S. Carey, of the Smithsonian Institution, Washington, D. C.; Dr. Mildred Mathias (Mrs. Gerald Hassler), Research Associate, University of California, Berkeley; Mrs. L. Sherman Adams, of the L. Sherman Adams Co., Orchid Growers, Wellesley, Mass.

STATISTICAL INFORMATION FOR APRIL, 1941

GARDEN ATTENDANCE:	
Total number of visitors	28,110
PLANT ACCESSIONS:	
Total number of plants and seed packets received as gifts	1,076
LIBRARY ACCESSIONS:	
Total number of books bought	6
Total number of books and pamphlets donated	30
HERBARIUM ACCESSIONS:	
By Gift—	
Anderson, E.—Miscellaneous duplicates	4
Brenner, Louis, G., Jr.,—Missouri mosses	3
Chandler, Albert—*Pteris multifida* from Arkansas	1
Coppinger, Martha L.—*Docynia docynioides* Rehd. from horticulture	1
Cory, V. L.—Plants of Texas	6
Cutler, Hugh C.—Plants of Texas	8
Davis, R. J.—*Apocynum pumilum* (Gray) Greene	1
Evers, Robert A.—Plants of Illinois	131
Fosberg, F. R.—Plants of Peru	2
Hanna, Leo A.—*Teesdalia nudicaulis* (L.) R.Br.	1
Hawk, H. A.—Plants of Oklahoma	20
Heath, E. S.—*Obolaria virginica* L. from Georgia	1
Heinrichs, J.—Plants of Nevada	2
Hershey, A. L.—Plants of New Mexico	29
Hubricht, Leslie—Plants of Missouri	25
James, R. L.—*Epigaea repens* L. from Alabama	1
Otto, Mrs. T. H.—*Prunus virginiana* L. from horticulture	1
Sperry, Omer E.—Plants of Texas	2
Thomas, J. W.—*Calicium polyporeum* Nyl. from Wisconsin	5
Williams, L. O.—*Habenaria avicula* Schltr. from Panama	1
By Exchange—	
Royal Botanic Gardens, Kew, England—*Calochorti* from Mexico	6
U. S. Department of Agriculture, Division of Mycology and Disease Survey, Washington—Fascicle II "Reliquiae Seymourianae"	183
University of Tennessee, by A. J. Sharp—Plants of Tennessee, Wyoming, Virginia, etc.	100
University of Washington, Seattle, by C. L. Hitchcock—Plants of Oregon, California, Nevada, and Mexico	714
	1,248

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Field Museum Notes

For sale by the Missouri Botanical Garden. Price $3.00

MISSOURI BOTANICAL GARDEN BULLETIN

Vol. XXIX JUNE, 1941 No. 6

SPECIAL NUMBER
FIRST MEETING CACTUS AND SUCCULENT SOCIETY OF AMERICA
ST. LOUIS, JULY 4-6, 1941

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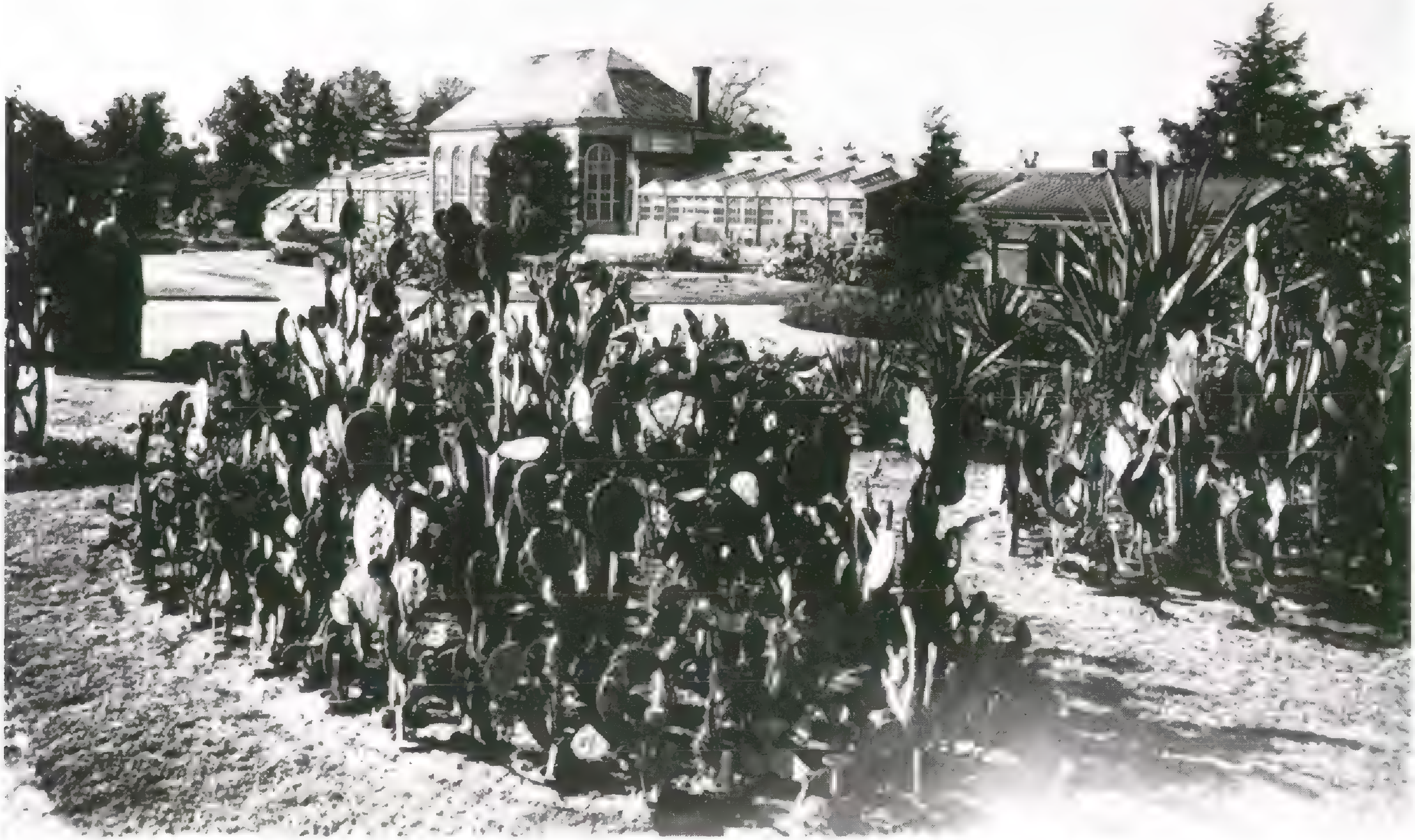
SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date to the death of Mr. Shaw, in 1889, the Garden was maintained under the personal direction of its founder, and while virtually a private garden it was, except at certain stated times, always open to the public. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was designated by Mr. Shaw as its official title and in his will and all of his writings he specifically referred to it as the "Missouri Botanical Garden." By a provision of Mr. Shaw's will the Garden passed at his death into the hands of a Board of Trustees. The original members of the Board were designated in the will, and the Board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provison of the will, the immediate direction of the Garden is vested in a Director, appointed by the Board of Trustees. The Garden receives no income from city or state, but is supported entirely from funds left by the founder.

The city Garden comprises 75 acres, where about 12,000 species of plants are growing. There is now in process of development a tract of land of over 1,600 acres outside the city limits which is to be devoted to (1) the propagation and growing of plants, trees, and shrubs, designed for showing either indoors or outside, at the city Garden, thus avoiding the existing difficulties of growing plants in the city atmosphere; (2) gradually establishing an arboretum as well as holding a certain area as a wild-flower reservation, with the idea that possibly at some future time this may become the new botanical garden.

The Garden is open to the public every day in the year except New Year's Day and Christmas—week days from 8:00 a. m. until sunset; Sundays from 10:00 a. m. until sunset. The greenhouses are closed every day at 5:00 p. m.

The main entrance to the Garden is located at Tower Grove Avenue and Flora Place, on the Sarah car line (No. 42). Transfer south from all intersecting lines. The Garden may also be reached by the Tower Grove bus (No. 21).



CACTUS GARDEN NEAR MAIN ENTRANCE DURING THE EARLY DAYS OF THE GARDEN

Missouri Botanical
Garden Bulletin

Vol. XXIX JUNE, 1941 No. 6

HISTORY OF THE SUCCULENT PLANT COLLECTION AT THE MISSOURI BOTANICAL GARDEN

There is history and romance connected with the Succulent Plant Collection at the Missouri Botanical Garden. Fifty years have elapsed since the first records were begun, and no doubt the desert collection was started much earlier although in Henry Shaw's lifetime no catalogue was issued. Mr. Shaw went far out into the country, beyond the confines of early St. Louis, and there transformed an almost worthless tract of land into a gentleman's private garden. This is history, and surely some of the romance must linger around this exploit.

Most readers of the Garden's Bulletin are already aware of the history of the founding of Shaw's Garden. The philanthropic Englishman for some time had in mind a great botanical institution which would not only afford pleasure to those who loved flowers, shrubs and trees, but at the same time would be of great service in a scientific way. It was Professor Trelease who came to St. Louis in 1885, on Henry Shaw's invitation, to help him realize this dream of a botanical garden. Mr. Shaw also conferred with and received advice from eminent botanists such as Dr. George Engelmann, Dr. Asa Gray, and Sir Joseph Hooker of Kew, England.

The writer has made an attempt to assemble all the noteworthy facts about the Succulent Plant Collection since its inception fifty years ago. It should form an interesting appendix to the "Guide to the Succulent Plant Collection," published in 1938.

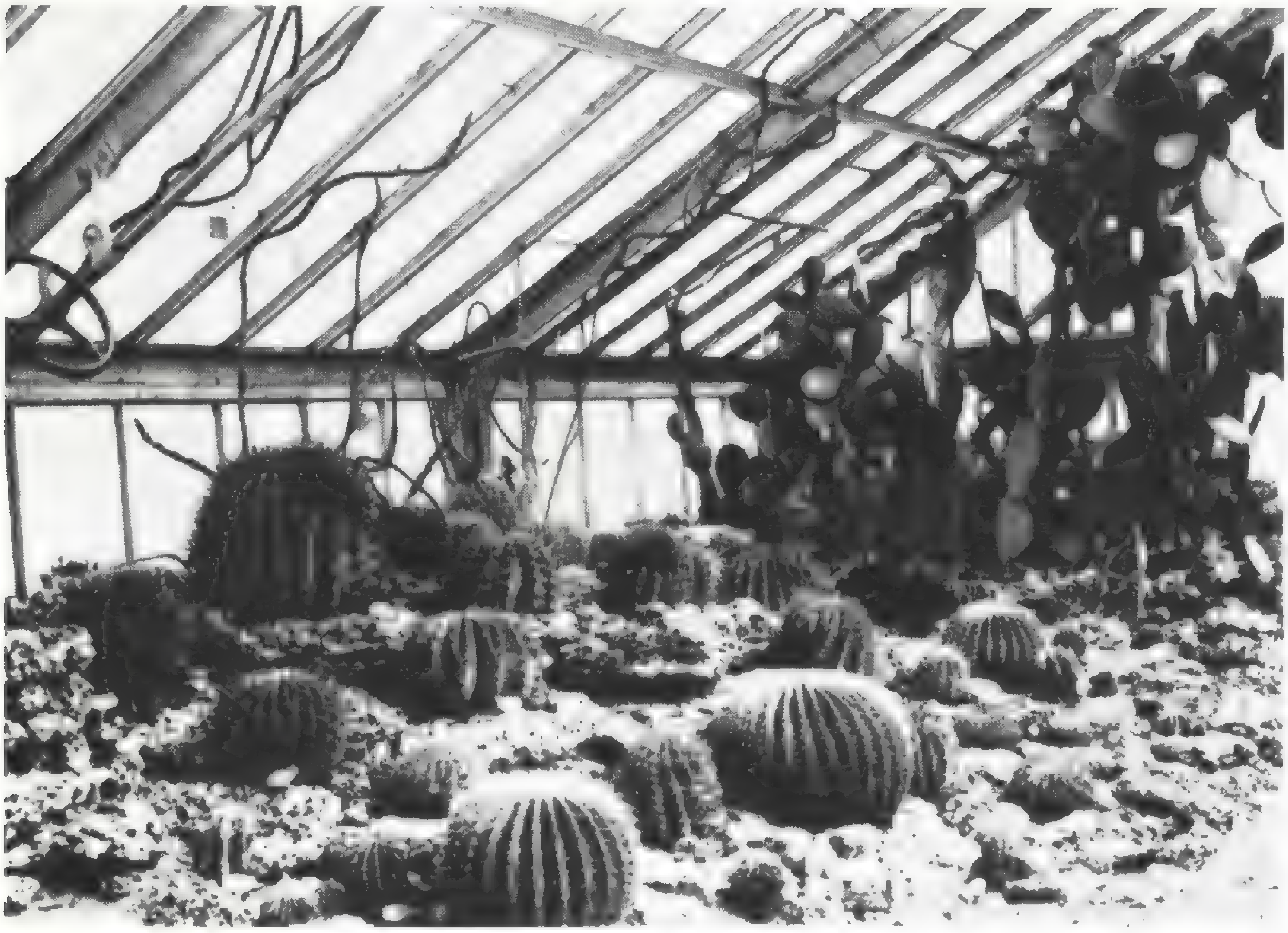
EARLY HISTORY

In 1890, after the death of Henry Shaw, Professor Trelease submitted his first report as Director of the Missouri Botanical Garden. "At present," wrote Trelease, "it is impossible to state the number of species in cultivation in the Garden, but it is very considerable and receives constant additions." The administrator of the estate had made an inventory and listed fifty-five species or varieties of Agave, and the collection of Cacti and of several other groups that interested the late Dr. Engelmann was said to be quite considerable.

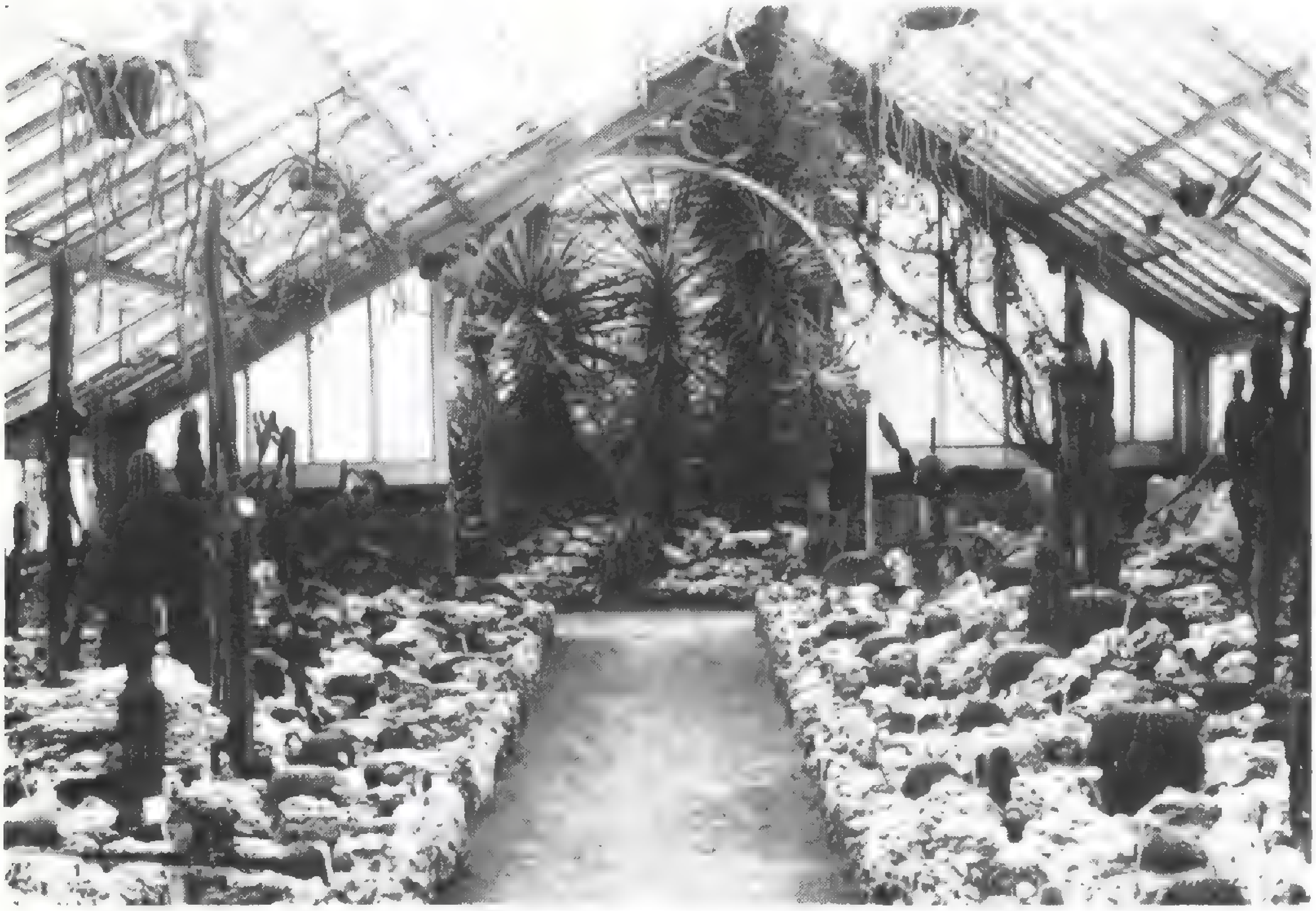
Dr. George Engelmann, physician and close friend of Henry Shaw, had carved for himself a secure niche in the botanical and medical world. Fortunately he had chosen St. Louis for his adopted home and eventually he made acquaintance with the founder of the Missouri Botanical Garden. Many learned men were numbered among his friends, and one of these was Prince Salm-Dyck, a noted European horticulturist. In pursuit of botanical studies, Dr. Engelmann started his own private garden where he raised the plants which the botanists and collectors of that day presented him. Salm-Dyck contributed regularly to this garden and, prior to 1860, had sent him a number of Opuntias and many other interesting succulents. After Engelmann's death, on February 4, 1884, most of his living collection was transferred to the private garden of Henry Shaw. None of his original plants are alive today, but his herbarium is deposited in the Missouri Botanical Garden, where it is made available to research workers.

Since Engelmann was so intimately identified with Henry Shaw and his hobby, the Garden's founder authorized the publication of Engelmann's researches as a memorial to him, thus making available the clear concise descriptions of new plants and the wonderful plates which illustrated them. While little actual exploration and collecting was done by Engelmann, in many instances he came to the aid of those who did go forth and much of the material collected was forwarded to him for identification. The eminent doctor was considered the foremost cactologist of his day and to him were entrusted most of the cacti of the United States-Mexican Boundary Survey.

It seems fitting to include here a list of some of Engelmann's species. By no means is it complete, but should give a fairly good



SCENE IN THE OLD CACTUS HOUSE, 1904



VIEW IN OLD CACTUS HOUSE, 1914

idea of his work on the Cactaceae. Today some of these species have been transferred to newer genera by such authors as Rümpler, Britton, Rose and others.

CEREUS
chloranthus
conoideus
ctenoides
dubius
Fendleri
giganteus
Greggii
gummosus
longisetus
mamillatus
mojavensis
nudiflorus
pecten-aboriginum
rigidissimus
Roetteri
Schottii
stramineus

ECHINOCACTUS
brevihamatus
intertextus
Lecontei
Orcuttii
polyancistrus
polycephalus
setispinus
Sileri
Simpsonii
unguispinus
Whipplei
Wislizeni

ECHINOCEREUS
adustus
coccineus
dasyacanthus
enneacanthus
pectinatus
polyacanthus
triglochidiatus
viridiflorus

EPIPHYLLUM
obovatum

MAMMILLARIA
aggregata
applanata
barbata
chlorantha
compacta
dasyacantha
deserti
Echinus
fasciculata
gummifera
hemisphaerica
lasiacantha
macromeris
microcarpa
meiacantha
papyracantha
pectinata
radiosa
recurvata
similis
sulcata
tetrancistra
Wrightii

OPUNTIA
acanthocarpa
angustata
arbuscula
arenaria
Bigelovii
bulbispina
chlorotica
ciribe
clavata
clavellina
Davisii
echinocarpa
erinacea
fulgida
fuscoatra
Grahamii
grandiflora
hystricina
Lindheimeri
macrocentra
macrorhiza
mojavensis
occidentalis
Parryi

phaeacantha
procumbens
prolifera
pulchella
pycnantha
ramosissima
rufida
Schottii
serpentina
setispina
sphaerocarpa
Stanlyi
stenochila
stenopetala
strigil
tapona
tenuispina
tesajo
Thurberi
tortispina
versicolor
Whipplei

By 1895 there were over 500 species or varieties of succulents under cultivation at the Garden, of which 91 were Agaves, 306 Cacti, 93 Aloids, Cotyledons and Mesembryanthemums, and 51 Yuccas and Furcraeas.

On May 21, 1896, the first of destructive hailstorms visited the Garden. Some 6,000 lights of glass were broken and the fallen glass did incalculable damage to many plants. The cacti and other tropical plants were already set outdoors in the rockeries and many of these were either destroyed or so badly bruised that it was impossible to count the final loss. Thirty-one years later, on May 28, 1927, another hailstorm almost completely devastated the succulent collection, many notable specimens being lost or damaged beyond hope of saving. The ensuing summer rains aided in destroying such cacti as had been bruised by the falling glass.

In 1898 the Garden had 8,009 species of plants, of which all but one or two hundred were named with more or less accuracy. Of this number, 462 species were cacti and, according to the records, "were especially worthy of mention."

The earliest record of cactus donations is of February 2, 1890, when Monsieur Blanc of Paris, France, shipped thirty Echinocereus and an equal number of Mammillarias to the Garden. In the following year the collection was increased by noteworthy specimens from Frederico Pfeiffer, C. G. Pringle and Mrs. Anna B. Nickels. These three collectors contributed a number of Mexican cacti and century plants. About this time Professor Trelease began making periodic visits into the desert regions, and for many succeeding years continued to send shipments of Agaves, Yuccas and various Cacti.

A steady flow of succulents kept coming to the Missouri Botanical Garden during 1892, of which the most notable were contributed by Pike and Ellsworth, of Jessamine, Florida, Dr. Francis Eschanzier, of San Luis Potosi, Mexico, and the cactus firm of Haage and Schmidt, of Germany. Their lots consisted of many interesting pincushion, hedgehog and torch cacti, numerous striking century plants, and curious fig-marigolds. The German firm also included in its shipments a number of fascinating seedling Aloes.

Homer Bassford's name appears on the records for the year 1897. He was well known in literary circles, having served as reporter on the old *St. Louis Republic* and later as a feature writer for the *St. Louis Star* and *Times* and as managing editor of the *Star-Times*. To show his appreciation for the many happy moments that he spent in Shaw's Garden, he made a present of a number of cacti and succulents. C. R. Orcutt is another notable contributor of the nineteenth century, his plants coming mostly from the Colorado desert.

On October 22, 1904, the Mexican National Exposition Commission presented the Garden with an unusually large collection of plants, appraised at $2,564.20, that had been exhibited at the Louisiana Purchase Exposition in St. Louis. Among them were numerous Cacti, Agaves, Cycads and other exotics. Some of the oldest specimens now growing at the Garden are desert plants from this original stock. These include four *Echinocactus Grusonii,* one *Dasylirion quadrangulatum,* one *Dasylirion acrotrichum,* and a few others. From the United States Department of Agriculture, which also exhibited at the St. Louis World's Fair, the Garden received 4,810 fiber-yielding plants and young forest trees, valued at $511.50. The curious Yucca-like *Samuela carnerosana* is the lone xerophytic survivor from that consignment.

During the summer of 1909 many collectors were out in the field, and the Garden received some very noteworthy additions from them. E. O. Wooton sent *Echinocereus paucispinus, E. viridiflorus, Mammillaria meiacantha, Coryphantha neo-mexicana* and many other succulents from the Guadalupe Mountains in New Mexico. Professor Charles E. Bessey, of Lincoln, Nebraska, who vacationed at a ranch in Estes Park, Colorado, presented several specimens of *Echinocactus Simpsonii* var. *minor* which he had collected at an altitude of 8,500 feet. Dr. David Griffiths, the Opuntia expert, sent cacti from San Luis Potosi, Mexico, while liliaceous and amaryllidaceous xerophytes were donated by Professor Charles S. Sargent, Director of the Arnold Arboretum. Dr. J. N. Rose collected *Opuntia pulchella* and numerous Agaves, Nolinas, etc., from the sandy deserts of Nevada. J. H. Ferris, an enthusiastic plantsman of Joliet, Illinois, donated such hardy Yuccas as *Y. glauca, Y. angustissima* and various other succulents. Ferris was the editor of the *Joliet Daily News* and owner of a commendable succulent collection which he bequeathed to the city he served.

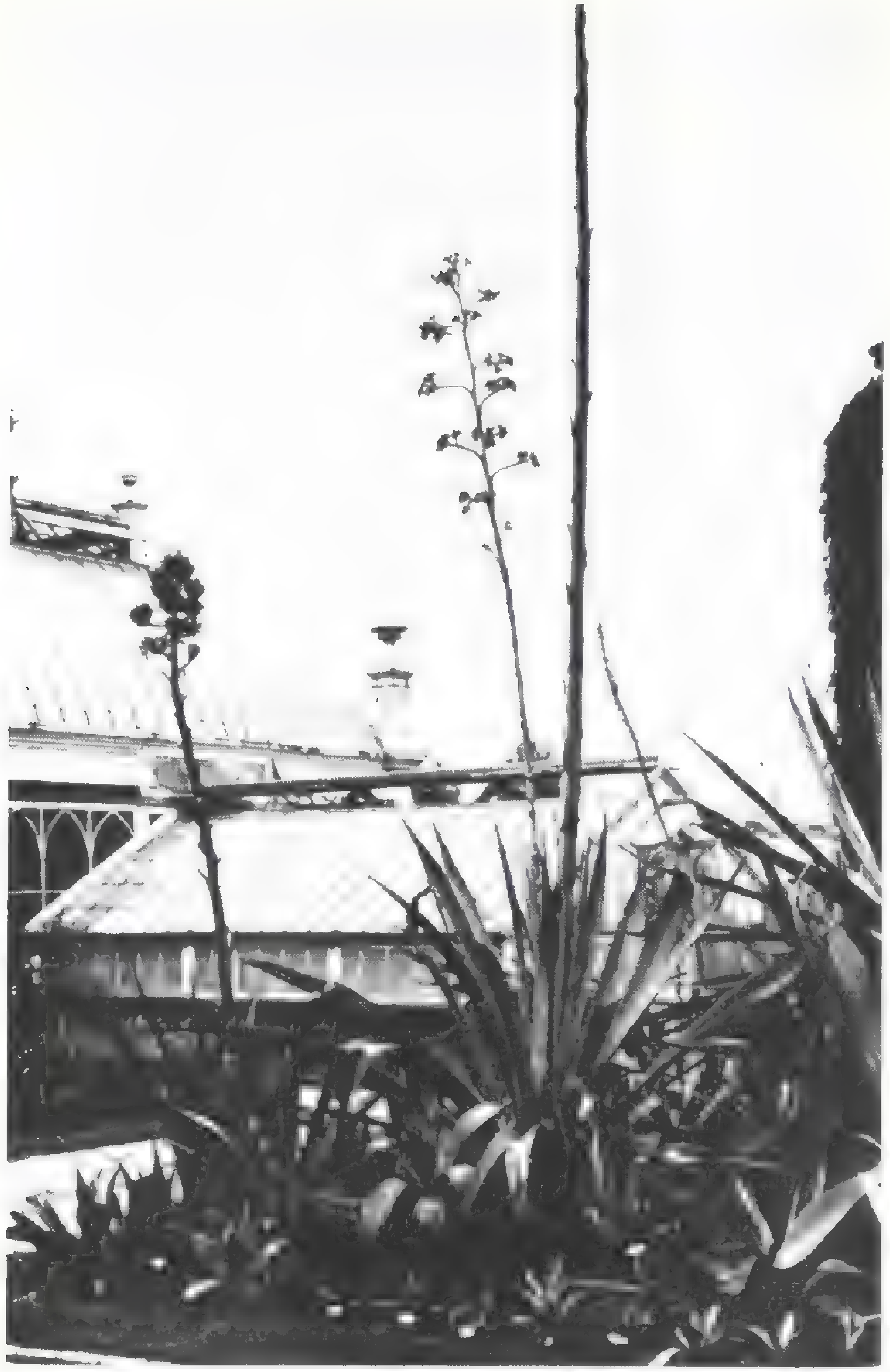
About this time, Charles H. Thompson, of the Garden staff began to secure seeds and plants from Texas and other southwestern states. His entries in the accession books are usually replete with interesting remarks. To cite just one—Agave sp. # 173: "growing on the property of Mr. W. H. Dodd, who brought the plant from the Santa Rosa Mountains, across the river in Mexico—where it was growing wild—The leaves have an odor of rhubarb, but taste nearly as bitter as quinine. The leaves are full of a fine silky fiber." Thompson's fame as a cactologist was far-spread and he is best remembered for his treatise on Ariocarpus and Lophophora, which appeared in the ninth ANNUAL REPORT OF THE MISSOURI BOTANICAL GARDEN. He was also co-author of a Government publication, now out of print, which was one of the first instructive booklets on cactus culture published in America.

The year 1910 was another fruitful year as regards acquisitions of succulent plants. A great number of well-known collectors deposited their specimens with the Garden. Mr. Thompson did extensive exploring in Mexico and added many interesting desert species to the ever-growing number of plants in cultivation. Mrs. Anna B. Nickels, during a sojourn in Mexico, managed to dig up a heterogeneous collection of Cacti, Agaves, Sedums and Hechtias which grew in profusion in the mountains on the outskirts of San Luis Potosi. Two famous Italian institutions, the Palermo Botanic Garden, and the La Mortola Gardens of Sir Thomas Hanbury, contributed Aloes, Cotyledons, Echeverias, Euphorbias, Mesembryanthemums, Haworthias and Cacti of the columnar type. Many Agaves and Furcraeas had arrived from various sources and parts of the Western Hemisphere. Director Trelease was making an exhaustive study of these plants and naturally welcomed every bit of living material he could gather.

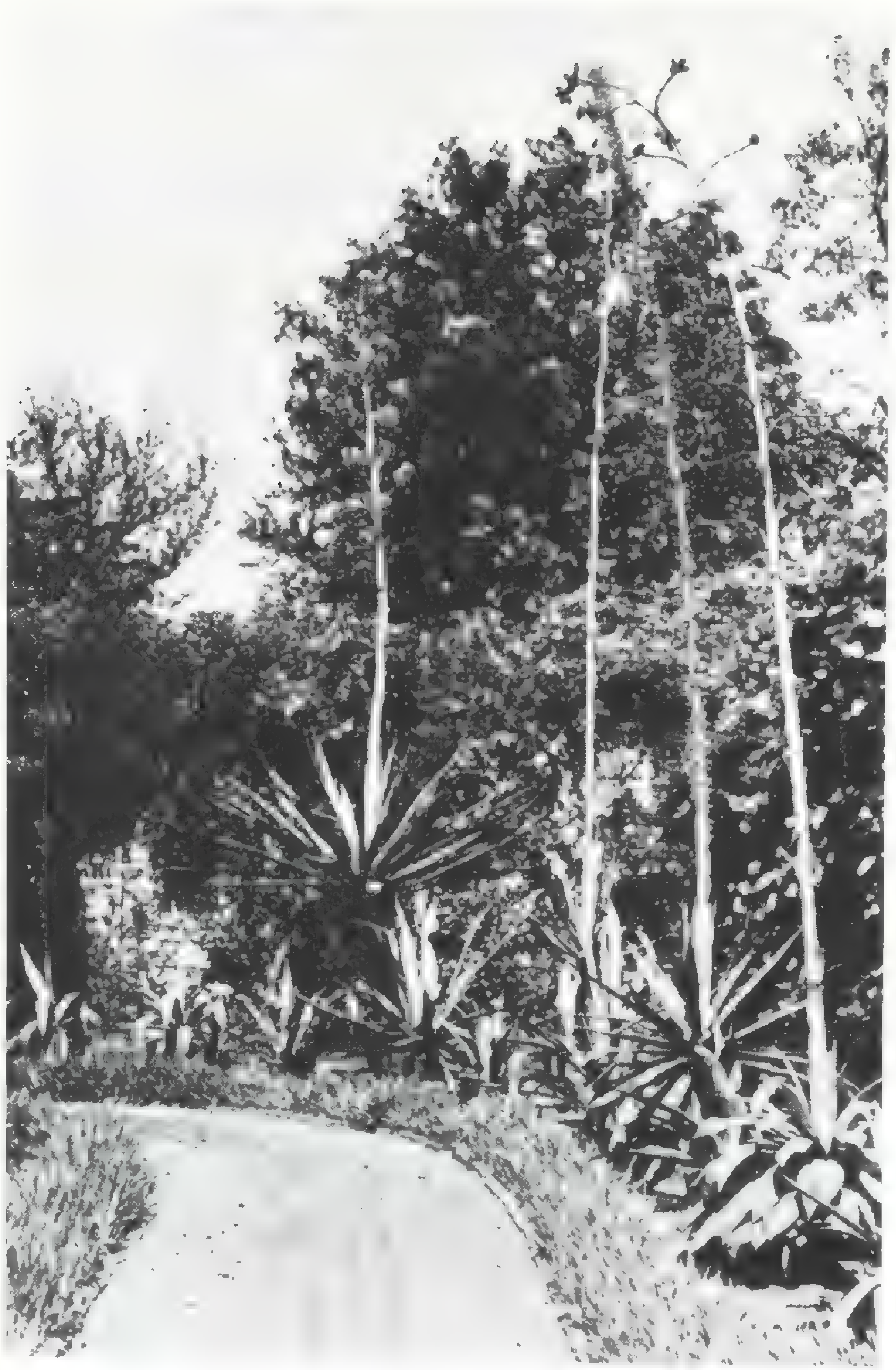
Public officials, professional collectors and plant-lovers responded to his plea. Governor Van Grol, of the West Indian Island of St. Eustatius, secured bulbils of the native century plant, and the New York Botanical Garden sent various Agaves from the Caribbean lands. Mexican species were obtained from Professor C. Conzatti, C. A. Purpus, Dr. F. Franceschi, and from Samuel E. Magill, the American Consul at Guadalajara. Important species were collected in the Bahamas, in Peru and in Costa Rica.

In 1911 a valuable collection of Lower Californian maguey plants was received at the Garden, all of them collected by Dr. J. N. Rose. Succeeding years continued to bring new members into the fold, although they did not arrive in such great numbers. During the thirteen years that elapsed between 1913-1926 very few desert plants were acquired, so there was a noticeable dearth of succulents. William H. Emig, a former research fellow at the Missouri Botanical Garden brought to the Garden, in August, 1917, specimens of *Echinocereus caespitosus, Coryphantha vivipara, Opuntia macrorhiza* and several other cacti, which he had collected in Oklahoma. Mr. C. T. Palmer, out on a plant-hunting trip in 1918, donated about fifteen varieties of cacti from the Southwest. Señor Manuel E. Reyes, of San Luis Potosi, another donor on the 1918 list, sent the Garden six cacti from Mexico. In 1919 Frank Weinberg shipped twenty-three cacti to the Garden collection. Mr. Weinberg, a cactus dealer now stationed in California, had been interested in these plants for a number of years, and in 1912 a stout Echinocereus was named for him. Robert Runyon, a photographer and plant collector of Texas, sent a small shipment of Ariocarpus, Cephalocereus and Coryphantha in April, 1925.

The vast assemblage of desert plants in Shaw's Garden came in for meritorious comment as early as 1891. At that time, C. R. Orcutt wrote in the *West American Scientist:* "The collection in this group is believed to be one of the largest and most complete in existence, and the library and herbarium of the Garden are also very rich in material referring to the cacti. The managers desire that every species of cactus growing in the United States, as well as Mexican species, shall be represented in the near future. For botanical study, as well as popular observation, St. Louis is likely for some time to come to be the cactus center of the country."



AGAVE GROUP IN 1905

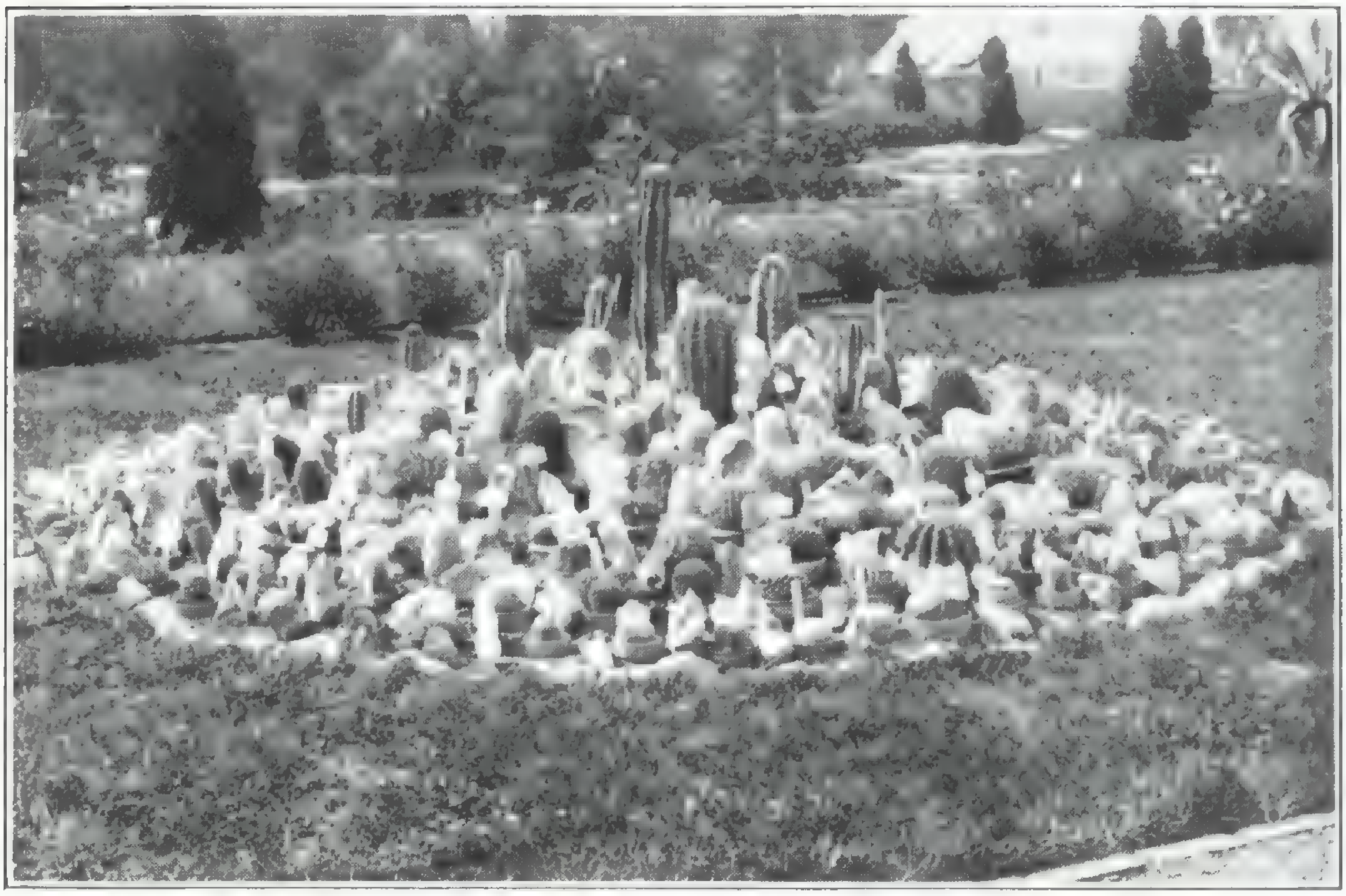


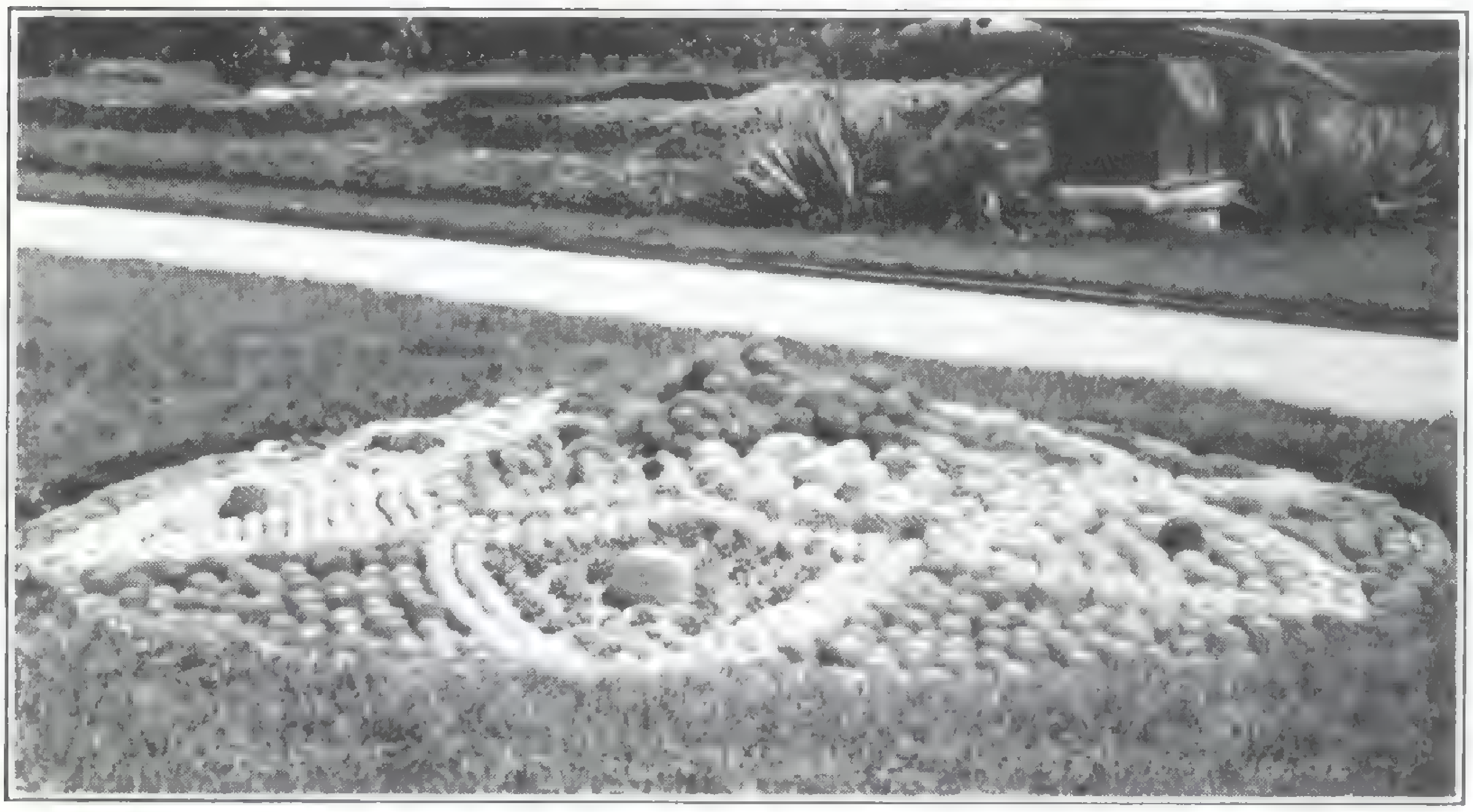
AGAVES IN FLOWER WEST OF GREENHOUSES IN THE OLD DAYS

Forty years or more ago the cacti were exhibited in outdoor beds in that portion of the present perennial garden just east of the Linnean House. Many of the Opuntias and Cerei were handsome old plants and possessed historic significance since they originally had come through Dr. Engelmann from Prince Salm Dyck, one of the greatest authorities on succulent plants. Gay flower-spattered vines hung gracefully over the red brick wall, against which were grouped tall prickly pears and various slender climbers of nocturnal-flowering Cereus. All the plants were in pots plunged in the soil, for by this method watering could be better controlled and there was less danger of losing them through rot. The plants also could be much more easily handled and removed into their winter quarters when frost threatened in the fall.

AGAVES DISPLAYED IN AN OUTDOOR BED
WEST OF THE AGAVE HOUSE

Separate beds were devoted to the more fascinating Mammillarias and bright-spined Echinocacti. Most of these were of the globular or semi-cylindric type, marked with ribs or tubercles and





TWO BEDS OF CACTI FORMERLY PLANTED AT THE GARDEN covered with either fierce or weak, needle-like spines. A mound-like rockery included a number of fleshy succulents with showy Sedums, colorful Echeverias and other dainty-leaved members of the Crassulaceae.

In later years cacti were featured in beds near the Main Entrance. Tree-like Opuntias blazed forth with blossoms of golden yellow, candelabriform Torch Cacti were sprinkled with buds that opened only in the night, pincushion-like Mammillarias displayed their bright coronets of dainty flowers, and hundreds of other cacti demanded attention. Nature's occasional shower, an abundance of sunshine, and invigorating air helped to produce marvelous growth on the desert plants. Innumerable Mammillarias of the Rhodantha and Compressa types were used in geometric designs on slightly elevated circular beds. Shields, diamonds, stars, rectangles and other intricate patterns were formed with these low-growing, colorfully-spined plants. A less formal bed consisted of a heterogeneous collection of cacti in various sizes and shapes. The tallest specimens were placed on a mound in the center while other specimens in graduated sizes radiated to the edge of the circular bed.

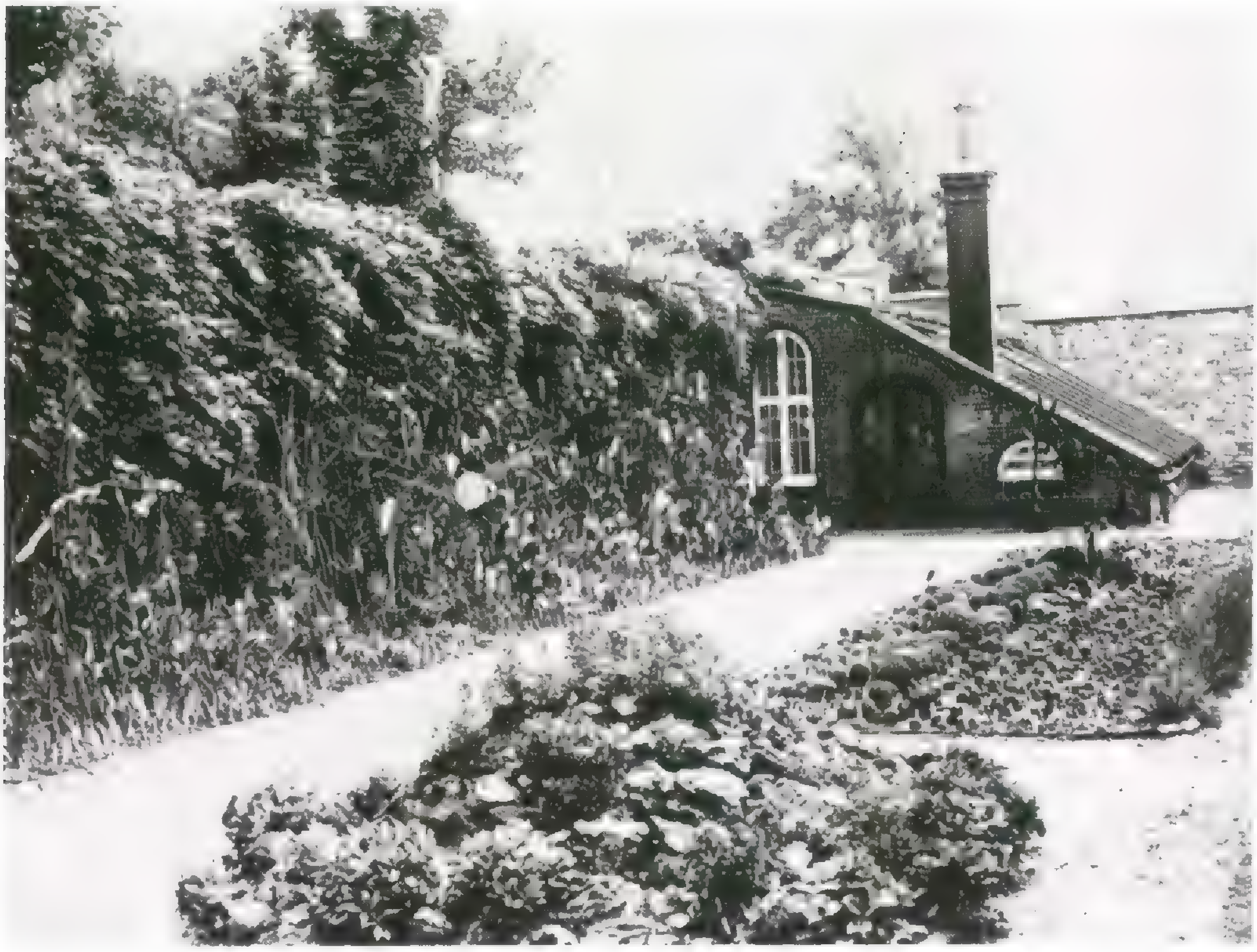
The method of exhibiting cacti in outdoor beds was a good one, but as these thorny plants grew in vigor and size they became extremely difficult to handle. In addition to the cacti being very heavy and prone to damage, their arms and pads were inclined to snap off and injure the men carrying the plants. Also, the procedure of moving required time and men. There was hope that at some future date a permanent house could be devoted exclusively to this group of plants.

In the old days the Garden greenhouses were not so imposing as they are today. The original ones stood on the site of the present Rose Garden. The Cactus room was small, at most only about 12 feet high at the gable ends. A great number of barrel cacti, particularly *Echinocactus Grusonii* and *Ferocactus Wislizenii,* were featured. There was also an Agave room and a Yucca dome filled with choice specimens of Agaves, Furcraeas, Yuccas, Nolinas and Dasylirions. At that time the Garden contained one of the best collections of liliaceous and amaryllidaceous xerophytes, special pets of Professor Trelease, who devoted much time to their study.

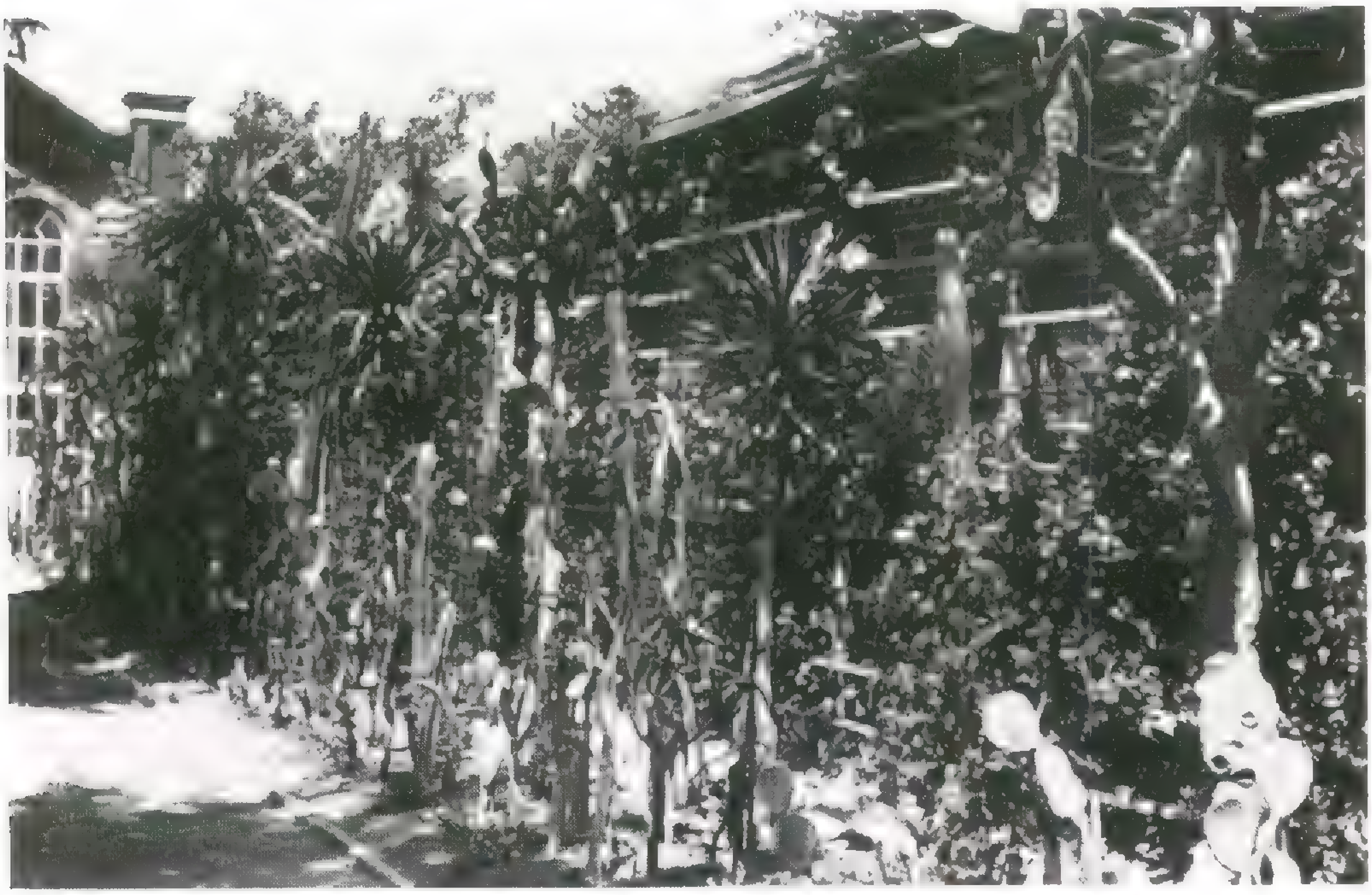
Not until 1915 was a permanent large-scale setting provided for the desert collection. The new conservatories were begun in 1912 and completed in June of 1913. The range consists of five houses, of which the largest, measuring 90 by 110 feet and 65 feet in height, occupies the central position and is devoted to palms.

VIEW IN THE OLD AGAVE HOUSE

The Palm House is flanked on the north by the Fern House and on the south by the Economic House, both rooms being 45 by 95 feet and 50 feet in height. Two long wings extend westward from the respective north and south houses, and these were used as floral display houses for nearly two years. Each wing measures



SUMMER CACTUS GARDEN IN THE OLD DAYS



CACTI BED EAST OF LINNEAN HOUSE, JULY, 1890

33 by 145 feet and is 40 feet high. When the present Floral Display House was completed in 1915 the two wings were prepared to receive the large collection of succulents and cycads.

The south wing, because of its exposure to longer sunlight, was chosen to be the permanent home of the succulents. A single wide-curving cinder path was constructed through the center and the two continuous beds were gradually sloped toward the side walls, almost completely concealing the steam pipes. The abundance of space available in the new Cactus House made it possible to dispense with the pot and tub culture and place the plants directly in the soil. At first the plants looked like dwarfs, the tallest ones averaging only about ten feet. There were a number of individuals of *Cereus jamacaru* which had accumulated from time to time, and these created a realistic scene when interspersed with a planting of Agaves, Yuccas, Aloes, Euphorbias and other queer desert plants.

One of the most outstanding of all the cacti represented in the collection was a huge eleven-foot saguaro, which was received a year earlier (1914) from Arizona. It is one of the most remarkable of plants and truly the most striking element in the desert vegetation of southern Arizona, where it grows in countless numbers. Although this gigantic cactus was known to Europeans as early as the sixteenth century its first official collection was in 1846, when Lieut. W. H. Emory made a military reconnoissance through the Southwest. Specimens were sent to Dr. George Engelmann at St. Louis, who formally described the plant in 1848. Sixty years later Drs. Britton and Rose re-christened it *Carnegiea gigantea.*

In 1892 the Garden's director, Professor William Trelease, dug up a giant cactus on the outskirts of Tucson, Arizona, and shipped it to St. Louis. This was the first saguaro at the Missouri Botanical Garden and apparently the first ever exhibited in the city. On November 13, 1893, another "giant" was secured from the Columbian Exposition in Chicago, where it had been on exhibition. It was received in a critical condition, according to the record, and later died, but it was retained at the Garden's Museum as a curiosity. The 1914 specimen, mentioned above, weighed over a thousand pounds, and in 1919 it bloomed. In the same year the great mass of plant rotted, leaving only its skeleton of perpendicular rods. The average life of the saguaro, under greenhouse conditions, seems to be approximately seven years. The plant grows extensive lateral roots which necessarily must be cut off for shipping, and under cultivation it is temperamental about producing new ones. The water-logged body can survive many years without a root system, provided no mechanical injury befalls it.

In 1922 the Bureau of Plant Industry sent the Garden a large specimen measuring eight feet in height and weighing approximately 800 pounds. It stood majestically in the Desert House until the memorable hail-storm of May, 1927, when it was battered by falling glass and finally killed by ensuing summer rains. The following year, Dr. Forrest Shreve, of the Desert Laboratory, Tucson, Arizona, replaced the dead saguaro with a seven-foot specimen. This behemoth of the St. Louis collection was repeatedly the butt of vandalistic attacks which finally contributed to its death in 1934. Some person had inflicted a deep gash in its side, causing bacterial rot to set in. Others had poked umbrellas into the succulent column to see whether water would gush forth. After the plant died its framework was exhibited in the Cactus House for nearly a year and drew much attention. Since then no attempt has been made to secure another large specimen, although several smaller ones with established root systems are thriving.

Probably it will be of interest to record here a few of the old plants which are still living, some of them thirty or more years old:

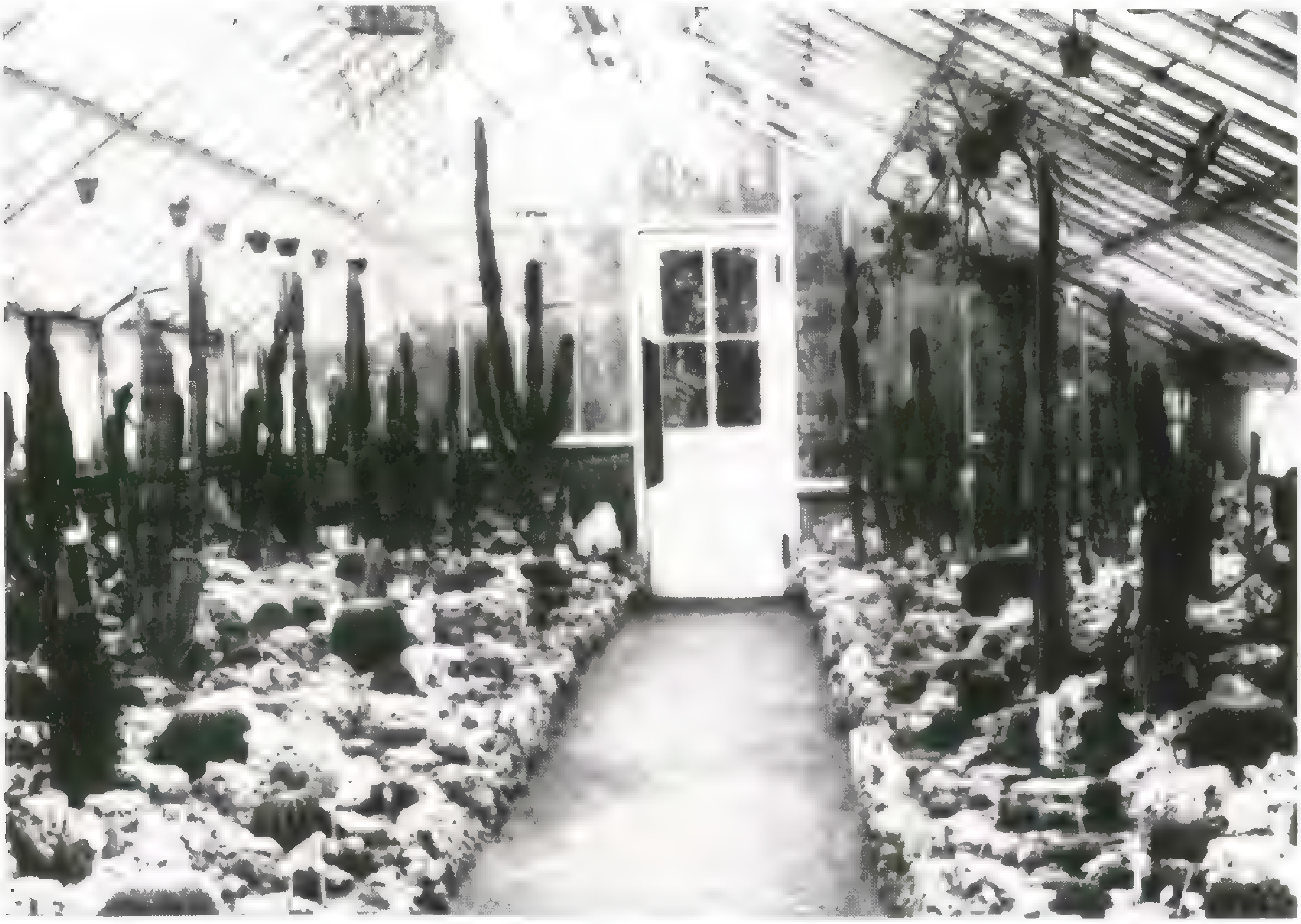
Cereus Dayami
Cereus grandicostatus
Cereus jamacaru
Cereus Hildmannianus
Echinocactus Grusoni
Dasylirion acrotrichum
Dasylirion quadrangulatum
Dasylirion serratifolium
Euphorbia Hermentiana
Euphorbia neutra
Euphorbia splendens
Euphorbia Tirucalli
Idria columnaris
Jatropha sp.
Lemaireocereus Weberi
Nolina recurvata
Pedilanthus tithymaloides
Pereskia Nicoyana
Samuela carnerosana
Yucca aloifolia

The tallest cactus in the collection is *Cereus Hankeanus,* whose topmost branches reach the roof. It is also one of the oldest, coming to the Garden in 1898. It is a prolific bloomer and bears about 200 flowers yearly, most of them maturing into crimson fruits with an abundance of seeds. A number of cacti were received in the early days under the name of *Cereus jamacaru,* but some have since proven to be other species. One such is *Cereus grandicostatus,* which up to 1940 reigned as the "King of Shaw's Garden Cacti," earning its title justly from its appearance. It was fifteen feet tall and sent up huge wide-spreading succulent arms from near the base. Probably no other cactus was so initial-scarred as this one. The plant collapsed in a heap on April 19, 1940—a victim of topheaviness. Although this robust cactus has been shorn of its magnificence it is already preparing to start life anew by sending up new growth from its injured branches.

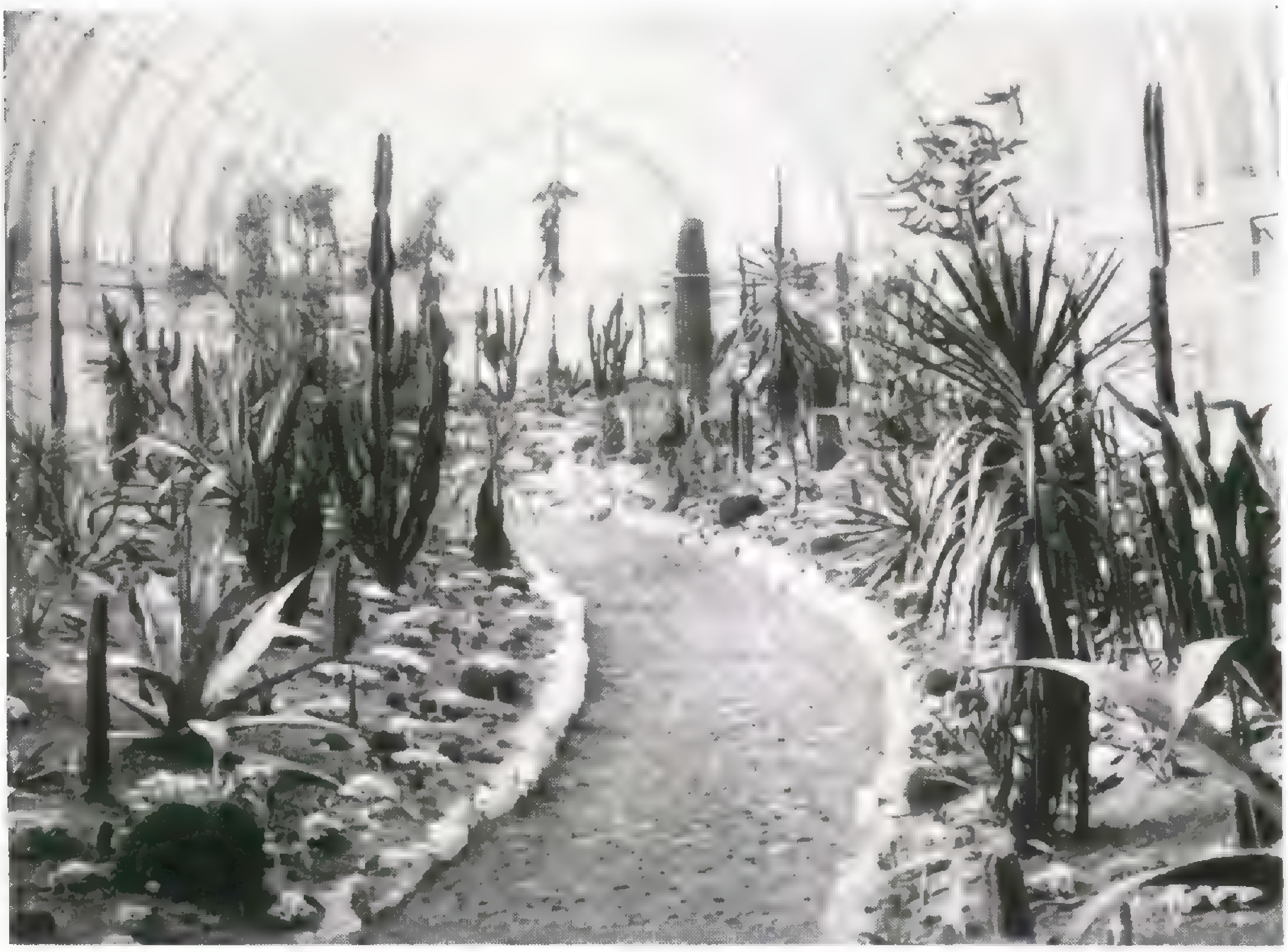
The living *Cereus Hildmannianus* was raised from seed ripening on the plant that had come into the collection in 1898. *Lemaireocereus Weberi* originated from seed collected by Charles H. Thompson on August 5, 1910, at Tomellin, Oaxaca, Mexico. Seed of *Pereskia Nicoyana* was secured from El Rancho, Guatemala, on February 26, 1902, and today is a tree about fifteen feet high.

A number of Euphorbias date back to the close of the nineteenth century. *Euphorbia Hermentiana* is one of the tallest and oldest of the spurges, being about forty-three years old. The popular "Crown of Thorns" was received in 1909, and six years later was removed to the northeastern corner of the Cactus House where it has remained ever since. Thousands of cuttings have been made from this plant and distributed to collectors and nurserymen. *Euphorbia Tirucalli,* the famous "fish-poison tree," was donated by Dr. J. N. Rose in 1911, who also sent *Pedilanthus tithymaloides* and *Euphorbia fulgens.* The ornamental *Dasylirion serratifolium* was germinated from seed in 1911, and today has a stem two and one-half feet high which is crowned by a dense rosette of more or less glaucous, spiny-margined leaves. In the spring of 1935 it bloomed for the first time, throwing out a flower stalk that attained a height of eleven feet.

Several xerophytic lily trees belonging to the genera Samuela, Nolina, and Yucca are numbered among some of the oldest specimens in the collection. Four weeping Nolinas grace the west background in the Cactus House and constantly attract attention by their enormous bulging bases. The two Samuelas date back to the St. Louis World's Fair of 1904. This genus commemorates Sam Farlow Trelease, young son of the Garden's first director, who ac-



VIEW IN THE OLD CACTUS HOUSE, 1914



THE PRESENT CACTUS HOUSE AS IT LOOKED WHEN FIRST PLANTED, IN 1915 companied and materially aided his father in a field study of the Mexican and Central American Yuccas.

Many persons prominent in the botanical world have contributed to the Succulent Plant Collection at the Missouri Botanical Garden. To mention just a few, there are the following:

Alwin Berger
Charles E. Bessey
C. Conzatti
George Engelmann
Frantz de Laet
F. Franceschi
David Griffiths
William Harris
R. E. Kunze
Mrs. Anna B. Nickels
Isaac Ochotarena
C. R. Orcutt
C. A. Purpus
Roland-Gosselin
J. N. Rose
Robert Runyon
Joseph Franz Salm-Reifferschid-Dyck
Charles S. Sargent
A. Tonduz
Frank Weinberg
C. Wercklé
E. O. Wooton

Alwin Berger was one of the most enthusiastic students of succulent plants. For a long time he was in charge of La Mortola, the beautiful subtropical garden near Ventimiglia, Italy. Many plants in our collection were received from this source. Berger is the author of several excellent treatises on succulents, one of them, a discussion of the genus Cereus, appearing in the sixteenth Annual Report of the Missouri Botanical Garden. Britton and Rose honored Berger when they created the monotypic genus Bergerocactus.

Charles Edwin Bessey was a professor of botany at the University of Nebraska and has been called "one of the greatest teachers that the world has known." Britton and Rose established the genus Neobesseya in commemoration of his name.

Professor C. Conzatti was a well-known botanist of Mexico, formerly the head of the Teachers' Normal School of Oaxaca and later director of the Botanical Garden of Oaxaca. Britton and Rose named one of the rat-tail cactuses in his honor, *Aporocactus Conzattii.* A number of Agaves have been received from him.

David Griffiths was the author of "Illustrated Studies in the Genus Opuntia" which appeared in Volumes 19-22 of the Annual Report of the Missouri Botanical Garden, and also of the government booklet on "Cacti," of which C. H. Thompson was co-author.

C. Wercklé, from the Museo Nacional, San Jose, Costa Rica, donated some specimens of succulents in 1912. His contributions of Costa Rican cacti greatly aided Britton and Rose in their study of the Cactaceae and in appreciation for his work they founded the genus Werckleocereus in 1909. Another Costa Rican aiding Britton and Rose was A. Tonduz, plant collector and naturalist, who sent Furcraeas for our collection. Cactus people will recall his name whenever *Rhipsalis Tonduzii* is encountered.

Professor Charles S. Sargent, first director of the Arnold Arboretum, which institution he served for fifty-three years, was a contributor to our collection. On assuming directorship in 1873 his prime desire was to make the Arnold Arboretum a garden of trees unsurpassed in America, and to this purpose he devoted all his energy.

William Harris, Superintendent of Public Gardens and Plantations of Jamaica, is distinguished for his contributions to the knowledge of the flora of that island. To commemorate his efforts Britton and Rose established the genus Harrisia for a group of night-flowering cacti.

Mrs. Anna B. Nickels frequently deposited all kinds of succulents with us. She was an ardent collector, and many modern works on Cactaceae cite her specimens and quote her notes on the properties and history of this group of plants. For many years Mrs. Nickels sent valuable consignments of plants of the Mexican boundary region to chemists, drug manufacturers, florists and botanists. She was among the first persons to bring to the notice of physicians that interesting mescal button, *Lophophora Williamsii.*

Professor E. O. Wooton is remembered for his "Cacti in New Mexico" and for the extensive "Flora of New Mexico" which he wrote with Paul C. Standley. Prior to 1908 he had established a cactus garden at Mesilla Park, New Mexico, where he grew most of the cacti known to exist in his state. C. R. Orcutt was a well-known writer and collector of desert plants, after whom one of the finest of Lower Californian cacti, *Pachycereus Orcuttii,* is named. Dr. C. A. Purpus collected extensively in Arizona, Utah, Nevada, and Mexico, recording his trips in various German publications.

The most famous of all the succulent collectors in Mexico was probably Cyrus G. Pringle, who was also one of the first to donate specimens to the Garden. He began his extensive travels in 1885 and covered most thoroughly the cactus region about the city of Monterrey. The showy, crimson-spined *Ferocactus Pringlei* on the rock-strewn slopes of northeastern Mexico is a fitting monument to his plant-hunting endeavors.

Frantz de Laet was a Belgian cactus dealer who had imported many plants from Mexico through Dr. C. A. Purpus and other collectors. A most remarkable hedgehog cactus, *Echinocereus De Laetii,* which resembles a small old man cactus, is named for him.

Salm-Dyck (1773-1861) was the most distinguished cactologist of his time, and at his estate at Düsseldorf, Germany, was one of the largest cactus collections ever brought together. He was a frequent contributor to Dr. Englemann's collection, and since that passed into the hands of the Garden after the latter's death it is supposed that some of the Salm-Dyck material was included.

MODERN HISTORY

Most of the succulents now on display date from the devastating hailstorm of May 28, 1927. Unarmed, fleshy plants such as Rhipsalis, Epiphyllums, Crassulas, Kalanchoes, Bryophyllums, Echeverias, Mesembryanthemums, Stapelias, Gasterias, Aloes and Euphorbias were practically destroyed or badly mutilated.

When the writer assumed charge of the succulents in 1930 he first made an inventory of all the plants in the Main Conservatory. The desert collection had dwindled to 157 named varieties and possibly 200 undetermined or with tags lost. An exchange was soon established with well-known collectors and dealers, and in 1932 the number of plants had increased to 462 named species of succulents, 144 being distinct members of the cactus family. Many packets of seeds were purchased, most of them being the interesting stemless Mesembryanthemums, popularly known as "mimic plants." In 1933 valuable additions were made, particularly in the line of succulent Euphorbias, Kalanchoes and Cacti. The following year it was decided to segregate the vast majority of the South African succulents and house them in another part of the Main Conservatory. The north wing, which formerly contained a coffee and banana plantation, was divided and the eastern half of it converted into a "South African" House. Approximately 120 species were removed from the Cactus House and transplanted into the new quarters. The transfers included Aloes, Gasterias, Crassulas, Kalanchoes and Mesembryanthemums. The succulent collection in 1934 numbered 700 species.

The original desert house of the new range, now popularly known as the Cactus House, was wholly renovated in 1935. Much of the old ground was carted away and the remainder mixed with leafmold and sand, to which some lime was added. Almost every plant was dug up and reset, with plants of the same group placed together so that the student would waste no time in locating the species in which he was interested.

In 1935 the writer made a trip to the desert regions of the Southwest to gather plants and seeds. Each year since, new regions are explored, and plants, cuttings or seeds collected. Not only plants of the fleshy type are brought back, but such typical desert xerophytes as the mesquite, ocotillo, ephedra, etc.

The desert collection at the Garden began to assume real proportions in 1936, at which time there were over 1,000 different species on display. Of this number 600 were of American origin, including the cacti, century plants, Spanish daggers, etc., while the remainder contained representatives of the flora of South Africa and other regions of the eastern hemisphere. Because the Missouri Botanical Garden had attained one of the most representative succulent plant collections under glass in America it was decided to publish a "Guide to the Succulent Plant Collection" in 1938, listing all the desert plants then in cultivation.

The succulents at Shaw's Garden really constitute an integral part in the plan of the institution, such as Henry Shaw may have had in his mind when he tended and watched over the plants during his lifetime. Every effort will be made to follow the founder's wish in "the study of the forms of vegetable life" and to make "experimental investigations in horticulture" as he had desired. Certainly cacti and succulents were included in his intentions.

L. C.

NOTES

Mr. George H. Pring, Superintendent of the Garden, acted as one of the judges at the annual flower show given by the Associated Garden Clubs of Kirkwood, on May 20.

Mr. George H. Pring gave a talk before the Carondelet Forum of the Young Men's Christian Association, May 21, on "Romance of the Plant World."

Mr. W. E. Hopper, Instructor in Biology, East-Alton Wood River Community High School, Wood River, Ill., brought his biology class of thirty-five students to visit the Garden library, herbarium, and outdoor collections, on May 31.

At the commencement exercises of Washington University, June 9, degrees were conferred on the following graduate students in the Henry Shaw School of Botany: Doctor of Philosophy—Edward C. Berry; Master of Science—Stanley Bettoney, Louis G. Brenner, Ralph W. Emons, and Ralph O. Erickson.

Mr. Ladislaus Cutak, in Charge of Succulents at the Garden, acted as one of the judges at recent flower shows sponsored by the following organizations: Sisterhood of Shaare Emeth Temple, University City, May 19; St. Louis Horticultural Society, May 24; St. Louis Hills Garden Club, May 31.

Mr. Cutak is the author of two articles in the May number of the *Journal of the Cactus and Succulent Society of America,* one entitled "St. Louis Will Welcome You" (**13**:70-72) and the other "The Missouri Botanical Garden" (**13**:73-74), both in connection with the first meeting of the Cactus and Succulent Society of America, in St. Louis, July 4-6. Another article, "The First Meeting of the Cactus and Succulent Society of America," appeared in the June number of *Garden Life* (**14**:44-46).

The Henry Shaw Gardenway Association held a memorial service for Lars Peter Jensen, at Jensen Point Overlook, Pacific, Mo., on June 1. The following program took place:

Introductory Remarks............Hon. C. F. Mayle, Mayor, Pacific, Mo.
Tributes to Mr. Jensen:
  A. J. Holthaus, Gray Summit, Mo.
  Col. H. D. McBride, Scout Commissioner, St. Louis Council, Boy Scouts of America
  Dr. Joseph Grindon, of the St. Louis Naturalists' Club
  Mrs. J. P. Larson, Past President, Federated Garden Clubs of Missouri
  Dr. George T. Moore, Director, Missouri Botanical Garden
  Theodore Wirth, Consulting Landscape Architect, Superintendent Emeritus Minneapolis City Parks
Address...Conrad L. Wirth,
Supervisor of Recreation and Land Planning,
National Park Service, Washington, D. C.

Dedication of Memorial Plaque................Mrs. Arthur J. Krueger,
President 8th District, Missouri Federation of Women's Clubs,
representing Henry Shaw Gardenway Association

Unveiling of Plaque.........................Mrs. Melvin Lickleider,
Granddaughter of Mr. and Mrs. L. P. Jensen

Benediction...William J. Morrill

In addition to the over 2000 St. Louis public schoolchildren who visited the Garden during the month of May, pupils of the following schools from Missouri and Illinois came to the Garden during the same period. The groups ranged in number from 25 to 100 each:

Maysville, Mo.
Elvins, Mo.
Darien, Mo.
O'Fallon, Ill.
Palestine, Ill.
East St. Louis High School, Ill.
Sweet Springs, Mo.
Decatur, Ill.
Cuba, Ill.
Salem, Ill.
Spencer School, Wellston, Mo.
Chester, Ill.
Lebanon, Ill.
Mill Shoals, Ill.
New Bloomfield, Mo.
Dupo, Ill.
Doniphan, Mo.
Noble, Ill.
Smithfield, Ill.
Litchfield, Ill.
Springfield, Ill.
Peoria, Ill.
Windsor, Ill.
Nebo, Ill.
Baldwin, Ill.
Finley, Ill.
Herrin, Ill.
Clayton, Mo.
Ullin, Ill.
Painter, Ill.
Greenup, Ill.
Mount Erie, Ill.
Wood River, Ill.

Among the recent visitors to the Garden were the following: Dr. Albert P. Blair, National Research Fellow, Columbia University, New York; Dr. Henry Schmitz, Dean of School of Forestry, University of Minnesota, St. Paul; Mr. H. A. Steavenson, of the U. S. Soil Conservation Service, Elsberry, Mo.; Dr. J. A. Steyermark, Assistant Curator of the Herbarium, Field Museum of Natural History, Chicago, and Mrs. J. A. Steyermark (Cora Shoop); Mr. Richard Wood, Graduate Student, Northwestern University, Evanston, Ill.; Mr. C. B. Breedlove, Biology Teacher, Amarillo Public Schools, Amarillo, Texas; Mr. Philip Leyendecker, Graduate Student, Iowa State College, Ames; Dr. Theodosius Dobzhansky, Professor of Genetics, Columbia University, New York; Mrs. Charles E. St. John, of Boston, Mass.; Dr. Elbert Swartz, Professor of Botany, University of Arkansas; Dr.

George Thomas Johnson, John Simon Guggenheim Research Fellow.

The Missouri Botanical Garden has always been known for its bird life, and it is interesting to note the birds observed during bird walks in the spring of 1941. The following list was compiled by Miss Clara Heising, Special Nature Study Teacher assigned to the Garden by the Board of Education:

Barn owl
Bluebirds
Bluejays (adult birds; nest)
Brown creepers
Brown thrashers (adult birds; young out of nest; nest)
Cardinals (adult birds; young out of nest)
Catbirds (adult birds)
Cedar wings (flocks)
Chickadees
Chimney swifts
Cowbirds
Crested flycatchers
Crows
Cuckoo, Yellow-billed
Duck hawk
Eagle
Flickers
Goldfinches (flocks)
Grackles (adult birds; nest; young out of nest)
House wren
Hummingbirds, Ruby-throat (adult birds)
Juncos (flocks)
Kinglets, Ruby-crowned (flocks)
Kinglets, Golden-crowned (flocks)
Louisiana water-thrush
Little blue heron
Maryland Yellow throat
Meadow lark (adult birds)
Mocking bird
Mourning doves (adult birds; nests; young out of nests)
Nighthawks (perching; flying)
Nuthatches
Oriole, Baltimore (adult birds)
Oriole, Orchard (one-yr. old male)
Oriole, Orchard (adult male)
Osprey
Oven bird
Pewee, Wood
Pigeons
Purple martins (adult birds)
Quails (adult birds)
Redwing blackbird (adult birds; nests; young)
Redstarts (adult birds)
Robins (adult birds; nests; young out of nests)
Sapsuckers, Yellow-bellied
Sparrow hawks
Sparrow, Chipping (adult birds)
Sparrow, English (adult birds; young out of nest)
Sparrow, Field (adult birds)
Sparrow, Fox (adult birds)
Sparrow, White-crowned (flocks)
Sparrow, White-throated (flocks)
Starlings (adult birds; nests; first and second broods out of nests)
Titmice, Tufted (adult birds)
Thrushes, Gray-checked (adult birds)
Thrushes, Olive-backed (adult birds)
Thrushes, Wood (adult birds)
Towhees (adult birds)
Veerys (adult birds)
Vireos, Red-eyed
Vireos, Warbling (adult birds; nests)
Warblers, Black and white
Warblers, Chestnut-sided
Warblers, Myrtle
Warblers, Tennessee
Warblers, Yellow (adult birds; nests)
Woodpecker, Downy
Woodpecker, Hairy
Woodpecker, Red-bellied
Woodpecker, Red-headed

STATISTICAL INFORMATION FOR MAY, 1941

GARDEN ATTENDANCE:	
Total number of visitors	40,716
PLANT ACCESSIONS:	
Total number of plants and seed packets received as gifts	711
LIBRARY ACCESSIONS:	
Total number of books bought	16
Total number of books and pamphlets donated	193
HERBARIUM ACCESSIONS:	
By Purchase—	
Avenue Camera Store—Photographs of type specimens	2
Eyerdam, Walter J.—Plants of Alaska and Washington	278
By Gift—	
Brown, William L.—*Poa cuspidata* Nutt. from Maryland, Virginia, and West Virginia	17
Coppinger, Martha L.—*Docynia docynioides* Rehd. from horticulture	1
Cutler, Hugh C.—Plants of Texas, New Mexico, Arizona, and Utah	234
Demaree, Delzie—Plants of Arkansas	24
Erickson, Ralph O.—Plants of Missouri	2
Eyster, H. C.—*Aster* sp. from South Dakota	1
Koch, Lucille—*Kerria japonica* DC. from horticulture	1
Lodewyks, Maude—*Buddleia alternifolia* Maxim. from horticulture	1
Pring, George H.—*Fagus* sp.	1
By Exchange—	
Arnold Arboretum—*Plants of Panama*	3
Rocky Mountain Herbarium, by A. Nelson—Plants of Alaska	211
U. S. National Museum—Apocynaceae from Venezuela	3
University of California, by T. H. Goodspeed—Plants of South America	51
By Field Work—	
Anderson, Edgar—Plants of Mississippi	22
By Bequest—	
Estate of the late Professor J. A. Drushel, estimated at	300
TOTAL	1,152

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American Midland Naturalist

"Should be of great use to local garden clubs, and for the scientific worker who is concerned with the local flora it should be invaluable."

National Horticultural Magazine

"Carefully and critically done, so that it should find wide and enthusiastic reception at the hands of all who enjoy being acquainted with the rich native flora of Missouri."

Rhodora

"The most comprehensive spring flora ever issued for any state. . . . Notable for presenting its data in simple non-technical English, yet with thorough scientific accuracy. Book's value not limited to Missouri."

Field Museum Notes

For sale by the Missouri Botanical Garden. Price $3.00

MISSOURI BOTANICAL GARDEN BULLETIN

Vol. XXIX SEPTEMBER, 1941 No. 7

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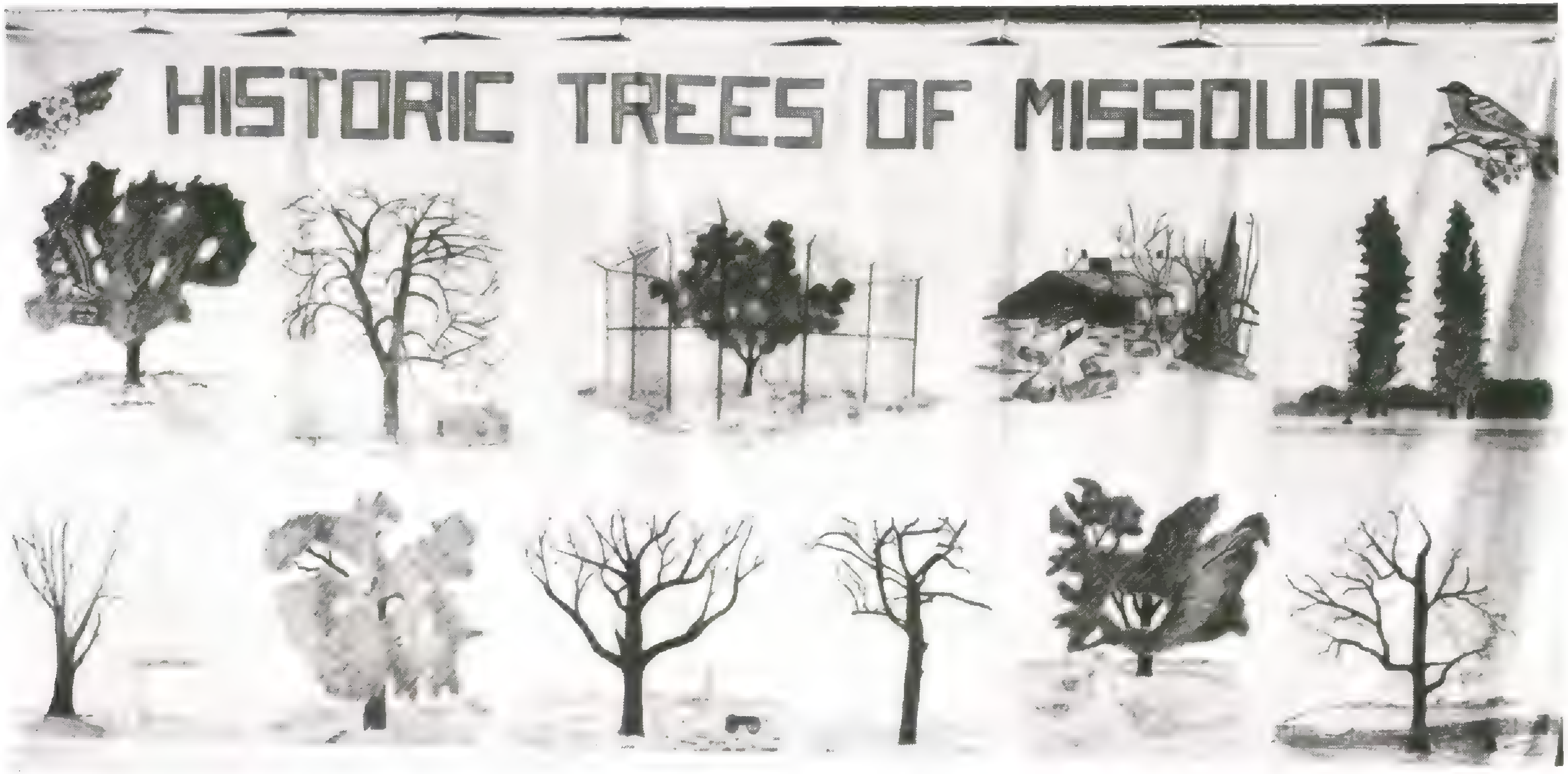
SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date to the death of Mr. Shaw, in 1889, the Garden was maintained under the personal direction of its founder, and while virtually a private garden it was, except at certain stated times, always open to the public. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was designated by Mr. Shaw as its official title and in his will and all of his writings he specifically referred to it as the "Missouri Botanical Garden." By a provision of Mr. Shaw's will the Garden passed at his death into the hands of a Board of Trustees. The original members of the Board were designated in the will, and the Board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provison of the will, the immediate direction of the Garden is vested in a Director, appointed by the Board of Trustees. The Garden receives no income from city or state, but is supported entirely from funds left by the founder.

The city Garden comprises 75 acres, where about 12,000 species of plants are growing. There is now in process of development a tract of land of over 1,600 acres outside the city limits which is to be devoted to (1) the propagation and growing of plants, trees, and shrubs, designed for showing either indoors or outside, at the city Garden, thus avoiding the existing difficulties of growing plants in the city atmosphere; (2) gradually establishing an arboretum as well as holding a certain area as a wild-flower reservation, with the idea that possibly at some future time this may become the new botanical garden.

The Garden is open to the public every day in the year except New Year's Day and Christmas—week days from 8:00 a. m. until sunset; Sundays from 10:00 a. m. until sunset. The greenhouses are closed every day at 5:00 p. m.

The main entrance to the Garden is located at Tower Grove Avenue and Flora Place, on the Sarah car line (No. 42). Transfer south from all intersecting lines. The Garden may also be reached by the Tower Grove bus (No. 21).



CURTAIN USED AT GRADUATING EXERCISES OF SCULLIN SCHOOL. FROM LEFT TO RIGHT, TOP ROW: SPRAY OF HAWTHORN, BLUEBIRD; MIDDLE ROW: D. WARD KING TREE, SIMMS OAK, "HALBERTA GIANT" PEACH, JAMES KENTUCKY COFFEE TREE, BALD CYPRESSES AT GARDEN ENTRANCE; BOTTOM ROW: LORIMIER ELM, BELMONT COTTONWOOD, GRANT OAK, PERSHING COTTONWOOD, HICKORY COUNCIL TREE, DANIEL BOONE JUDGMENT TREE.

Missouri Botanical Garden Bulletin

Vol. XXIX SEPTEMBER, 1941 No. 7

HISTORIC TREES OF MISSOURI

The following notes are by Miss Stella Michel, teacher of the eighth grade at the John Scullin School, St. Louis, and constitute part of the program arranged by her for the graduating exercises of the school, June 1941. Little of this material is published elsewhere; in fact, Miss Michel had to go to local sources in most cases, and the articles and illustrations usually represent laborious research and correspondence on her part. Not only because the facts are so little known, but also because of their interest to Missourians does it seem appropriate that these notes be published by the Garden.

Program

Theme

Historic Trees of Missouri

1. Chorus....................................“God of Our Fathers”
2. Opening Address..............................Jacquelyn Kleen
3. Reading: “The Hawthorn”.........................Tom Anderson
4. Reading: “The Bluebird”.........................Aliene Spencer
5. Reading: “The D. Ward King Tree”.................Robert Cayse
6. Reading: “The Simms Oak”......................Harry Villhardt
7. Girls’ Chorus:
    a. “Trees”
    b. “God Bless Thee, Old Missouri Mine”
8. Reading: “The Hal-Berta Giant Peach”............Mary Vassallo
9. Reading: “The James Kentucky Coffee Tree”........Paul Sieveking
10. Reading: “The Bald Cypress”....................Richard Hedrick
11. Reading: “The Lorimier Elm”...................Doris Humphries
12. Reading: “The Belmont Cottonwood”.......Marjorie Nowakowsky
13. Chorus:
    a. “Missouri State Song”
    b. “Let Us Sing of Old Missouri”

14. Reading: "The Grant Oak"..................Vernon Obergoenner
15. Reading: "The Pershing Cottonwood"..........Willadean Yeargain
16. Reading: "The Hickory Council Tree"............James Darrough
17. Reading: "The Boone Judgment Tree"........Marcella Grattendick
18. Reading: "The Big Oak"......................Georgianna Burch
19. Boys' Chorus:
    a. "Missouri Waltz"
    b. "My Missouri Home"
20. Reading: "The Blue Mills Ferry Maple"..........Parker Thompson
21. Reading: "The Savannah Elm"......................Audrey Sturm
22. Reading: "The Tucker Sycamore"......................Fern Keller
23. Reading: "The Maryville Elm"..............Lora Lee Bruckmann
24. Reading: "The Black Locust of Muegge's Ride"....Bernard Siemer
25. Reading: "The Lone Jack"..........................Jack Fechter
26. Awarding of Certificates by the Principal, Miss Percy A. Lyon
27. Chorus....................................."Our Scullin School"

OPENING ADDRESS

In behalf of the members of this class of June 1941, I bid you a hearty welcome to our exercises this morning. We are happy to see so many of our friends and loved ones present, and to know that you are interested in our welfare and progress.

We trust that you will enjoy our program, the theme of which is "Historic Trees of Missouri." On the curtain before you are certain illustrations, intimately connected with this theme, which reveal the interplay of social, political, and economic forces in Missouri's history: the hawthorn, the official flower of this state; the bluebird, Missouri's official bird; the D. Ward King Tree, a memorial to the inventor of the "Split Log Drag"; the oak which shades the grave of Richard Simms, a Revolutionary soldier; the "Hal-Berta Giant" peach, the first fruit tree on which a patent was ever granted; the shattered stump of the Kentucky coffee tree which stands within a few feet of the old cabin home of Jesse and Frank James, famous Missouri Robin Hoods; the bald cypresses growing at the Alfred Avenue entrance to Shaw's Garden; the elm which grows at the grave of Louis Lorimier, the founder of Cape Girardeau; the Belmont cottonwood used by the Confederates for chain anchorage to hold back Union gunboats in the Mississippi River; the oak under which Ulysses S. Grant received his commission as General during the Civil War; the 150-year-old cottonwood growing at the birthplace of General Pershing; the 300-year-old hickory "Council Tree" of Ste. Genevieve; and the Daniel Boone Judgment Tree.

Seven other trees, also closely identified with the early social and military history of this state, are not pictured on our curtain but do appear on our program.

As we today go forth into new and larger fields of endeavor, we pray that we may carry with us some of the characteristics of these "Historic Trees of Missouri"—the *uprightness* of the hickory, the *nobility* of the oak, the *strength* of the bald cypress, and the *hardiness* of the hawthorn.

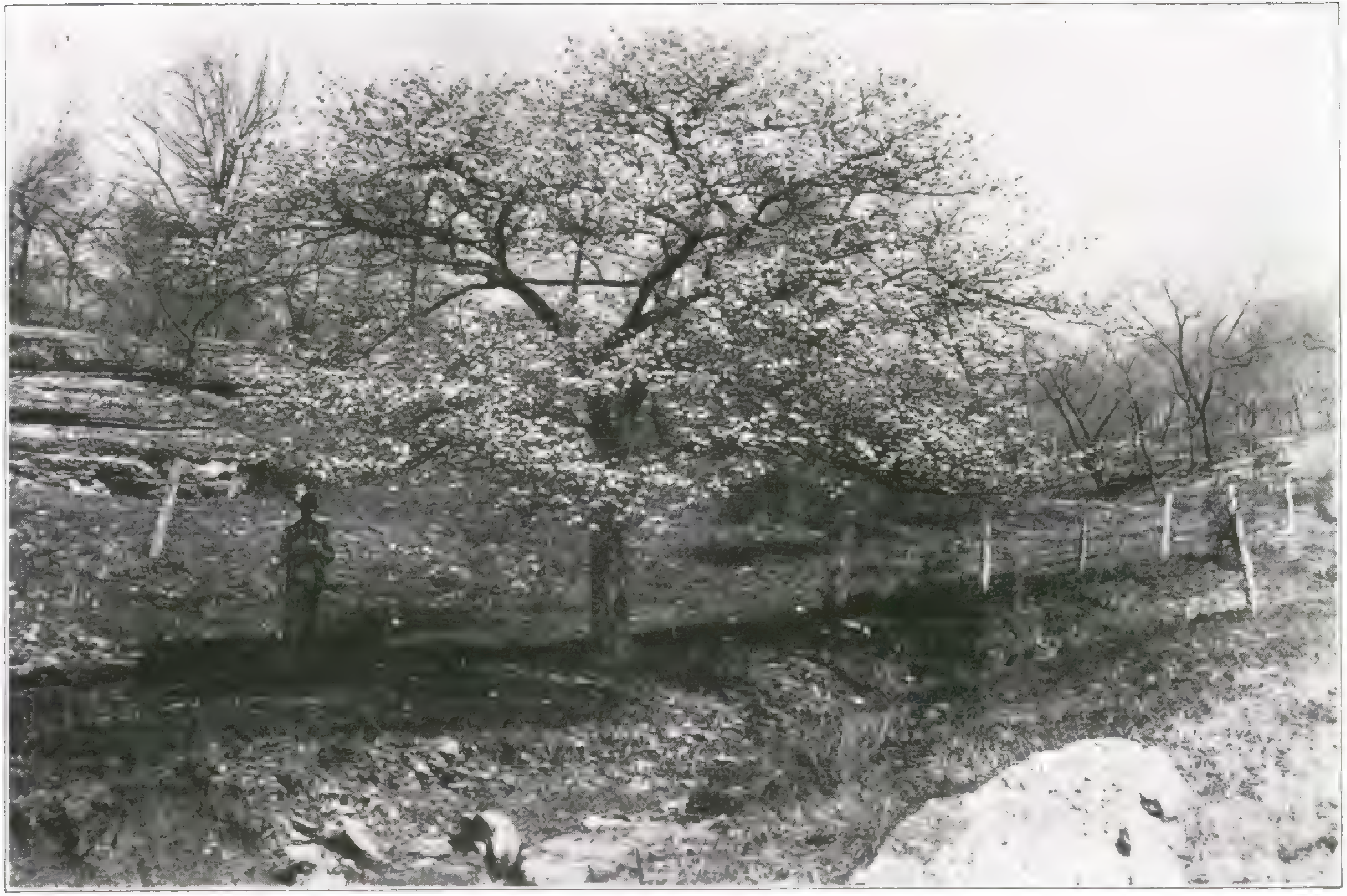
THE HAWTHORN

The bill to designate the hawthorn as our State Flower was sponsored by the Missouri Society, Daughters of the American Revolution, in 1919, and was introduced in the fifty-second General Assembly by Miss Sarah Lucile Turner, the first woman elected to the Missouri Legislature. Governor Arthur M. Hyde signed the bill March 16, 1923, and the hawthorn blossom became Missouri's official floral emblem.

Forty-four states had selected their state flowers before Missouri, with her wonderful wealth of native blossoms, chose hers. It was, perhaps, worth waiting a few years over a century to have for our official emblem the red or wild haw, as it is generally called, a flower unrivalled in beauty and honored in history, legend, and song.

The hawthorn grows in many states, but the experts on the botany of trees report that Missouri has the finest specimens and the greatest number of natural varieties and hybrids of any state in the Union or any other part of the world.

Closely related to the rose and the apple, the hawthorn blossoms in late April or May, according to the season. It grows in all parts of the state, and is very hardy and well adapted for park planting and landscape gardening. It is a shrubby tree, ranging in height from 3 to 30 feet, with stiff zig-zag branches set with thorns as long as 3 inches. Its white blossoms are borne in clusters, thus being symbolic of pure ideals, unity in endeavor, and strength in union. Its bright scarlet haws furnish a large per cent of the food for our winter birds and wild game. More birds nest in the dense foliage of its protecting branches than in any other native tree. The pioneers made jelly from the fruit of



HAWTHORN TREE, MISSOURI STATE FLOWER

some varieties and used its exceedingly fine-grained and hard wood in the making of shuttles for the weaver's loom.

In England, owing to its hardiness, close branches, and dense foliage, the hawthorn has been used for hedges and enclosures of fields since the days of the Roman occupation. In ancient Greece it was regarded as the emblem of hope, and its branches are said to have been carried in wedding processions. A legend also describes the staff of Joseph of Arimathaea to have been a branch of the strong hawthorn.

Of the 125 species growing naturally within our state, more than 50 fine specimens have been planted in the Capitol grounds at Jefferson City. Shaw's Garden has hedges and hedges of them, about 200 varieties, many native and some from other parts of the world.

As we drive along the highways throughout the state, especially in the Ozarks, and view the hills, dales, and woodlands sweet with budding haws and other blooms, we should rejoice that Missouri is the Hawthorn State.

THE D. WARD KING TREE

Overhanging Route 113 at Maitland, in Holt County, is a silver maple planted by and dedicated to the memory of David Ward King, the inventor of the "Split-Log Road-Drag." In the early 1900's a mile stretch of this highway which passed Mr. King's home was the first of the "good roads," so far as we know, in America or possibly elsewhere. On it Mr. King experimented with his drag and spent years of his life "pulling Missouri out of the mud." People used to come from miles around to try out the only smooth road, and Mr. King was even invited to foreign countries to introduce his dragged-road idea, but he refused to commercialize his invention.

David Ward King was born in Ohio in 1857 and settled in Holt County in 1879. At the time of his death in St. Louis, in 1920, he was attending a meeting of the Board of Directors of the Federal Land Bank.

Several years ago when the State Highway was coming through Holt County, the Kings were advised that the tree must go. Through the intercession of a member of the family, the blueprints were changed, and a curve in the road caused the maple

D. WARD KING SILVER MAPLE AT MAITLAND, HOLT COUNTY to be saved. Today the D. Ward King Tree graces the top of the hill at the edge of the historic road and continues to give of its shade and shelter to the hot, weary traveler.

THE SIMMS OAK

Seven miles northwest of Liberty, in Clay County, in a quiet, neglected spot in the center of a field, stands a sturdy oak which for ninety-one years has sheltered the grave of Richard Simms, a Revolutionary soldier.

Born in Virginia in 1752, Simms was a friend of George Washington, was with him at Valley Forge, and served in the 3rd Virginia infantry throughout the Revolution. He was granted land in Kentucky for his services and lived there a while, but moved on with his family to western Missouri in the early 1820's. He was a skilled cabinet-maker. A black walnut cradle which he fashioned in the 1840's is still in perfect condition in the home of a great-great-grandson in Liberty.

Simms died in 1850 at the age of 98 and was laid to rest in the family burying plot he had established. His grave was marked in 1912 by the Alexander Doniphan Chapter of the Daughters of the American Revolution.

Today his land is farmed by others; the family graveyard, unused for half a century, is surrounded by fields of hay, corn, and tobacco; the old homestead, far off the road, stands deserted with its logs showing beneath the rotting weather-boarding; but a gushing spring, with its wealth of water as clear and pure as it was when Simms settled there over a 100 years ago, remains as he knew it.

Surrounded by the graves of Richard Simms' sons and daughters, their mates and children, and his slaves, this great white oak shades the resting place of a Missouri pioneer who found Kentucky too settled at the close of the Revolution and pushed on to this newest frontier.

THE "HAL-BERTA GIANT" PEACH

On September 6, 1930, James E. Markham of Xenia, Clay County, Illinois, filed with the U. S. Government an application for a patent which was later assigned to the Stark Nurseries at

THE RICHARD SIMMS OAK NEAR LIBERTY, CLAY COUNTY (WHITE OAK)

Louisiana, Mo. This invention, which represented improvements in peach trees and their fruit, was patented February 16, 1932, as Plant Patent No. 7, and became *the world's first patented peach.*

This new peach, bearing the name "Hal-Berta Giant," was originated through cross-pollination and combined the delicious flavor and firm flesh of the "J. H. Hale" with bumper crops like "Elberta." When purchased by the Starks, this tree brought the highest price ever paid for a peach tree in the world's history.

The distinctive feature of the fruit of the "Hal-Berta Giant" is its uniformly large size, each peach averaging somewhat over three inches in diameter and weighing nearly a pound. It is a yellow freestone with almost fuzzless skin and a small stone.

The picture on our curtain is of the original or "Mother Tree."

THE JAMES KENTUCKY COFFEE TREE

Northeast of Liberty, in Clay County, stands the stump of a 90-foot Kentucky coffee tree which was blown down during a storm several years ago. This tree was planted by the Reverend Mr. Samuels, a circuit-rider preacher and stepfather of Frank and Jesse James. In its prime it was 16½ feet in circumference with four or five main trunks extending high in the air.

This stump stands within a few feet of the old cabin where Jesse James was born in 1847, and in a corner of the yard where, in 1882, he was buried. From her windows his mother could look upon the mound at the foot of the big Kentucky coffee tree.

Today the old homestead is the property of Frank James' son Robert, who, with his wife, lives on the place, but the remains of Jesse have been moved to Kearney.

THE BALD CYPRESS

According to the BULLETIN OF THE MISSOURI BOTANICAL GARDEN, Missouri's most interesting tree is the bald cypress, a member of the pine family, and closely related to the redwoods of California. It is a very distinctive tree which thrives in the swamp lands of southeast Missouri.

Today the bald cypress is one of the noblest forest trees of America. The straight, spire-like trunk, covered with a soft, fibrous, brownish bark, frequently attains a height of 125 to 150 feet. The base of the trunk is usually somewhat swollen and may measure over 30 feet in circumference. Perhaps the most distinctive feature of these trees is the production of numerous

THE JAMES KENTUCKY COFFEE TREE NEAR LIBERTY, CLAY COUNTY woody "knees" projecting from the soil around the trunk and ranging from small snags only a few inches above the ground to slender and irregular cones nearly as tall as a man. These "knees" are breathing structures which transmit air to the roots in the wet seasons when the lowlands are flooded. The foliage is very dense, and consists of many flat needles borne at the end of small twigs.

BALD CYPRESSES AT ALFRED AVENUE ENTRANCE TO THE GARDEN

Henry Shaw, the founder of the Missouri Botanical Garden, early recognized the stateliness and beauty of the native cypress of the Missouri swamps, and was courageous enough to plant it in large numbers on his estate, "Tower Grove" (now "Shaw's Garden"), and Tower Grove Park. This collection apparently has no counterpart in cultivation anywhere in the world.

In the center of Tower Grove Park is a stately avenue of bald cypresses over a half mile in length, many of which were planted almost 90 years ago by Mr. Shaw. These have attained a height of 75 to 80 feet and a diameter near the base of from 2½ to 3 feet. Only one specimen has remembered to send up a series of small "knees" and those merely a few inches high.

Today thousands of young bald cypresses are growing in the nurseries of the Garden, many of which are being used to establish impressive plantings near Gray Summit in honor of Missouri's most interesting tree, admired by Henry Shaw nearly a century ago.

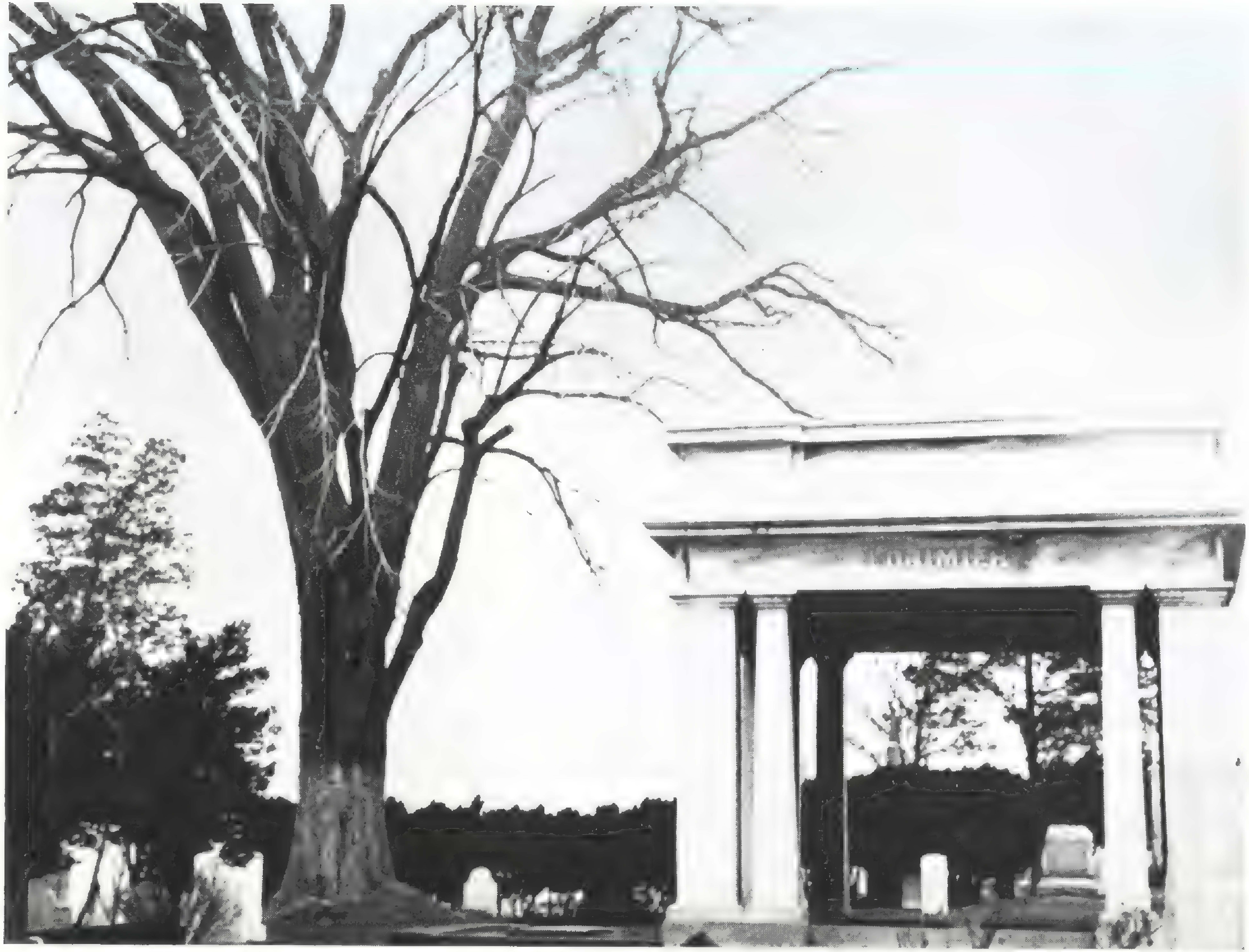
THE LORIMIER ELM

In Cape Girardeau, in the old family cemetery of Don Louis Lorimier, Spanish commandant of the military trading post at that town, there is a tomb erected about 1820 over the grave of Don Louis by the executors of his estate. The people of Cape Girardeau at a later date built a pagoda over this tomb in memory of the man who, during the Spanish regime, was of so much use in controlling and keeping friendly the Shawnee and Delaware Indians who resided north of the post.

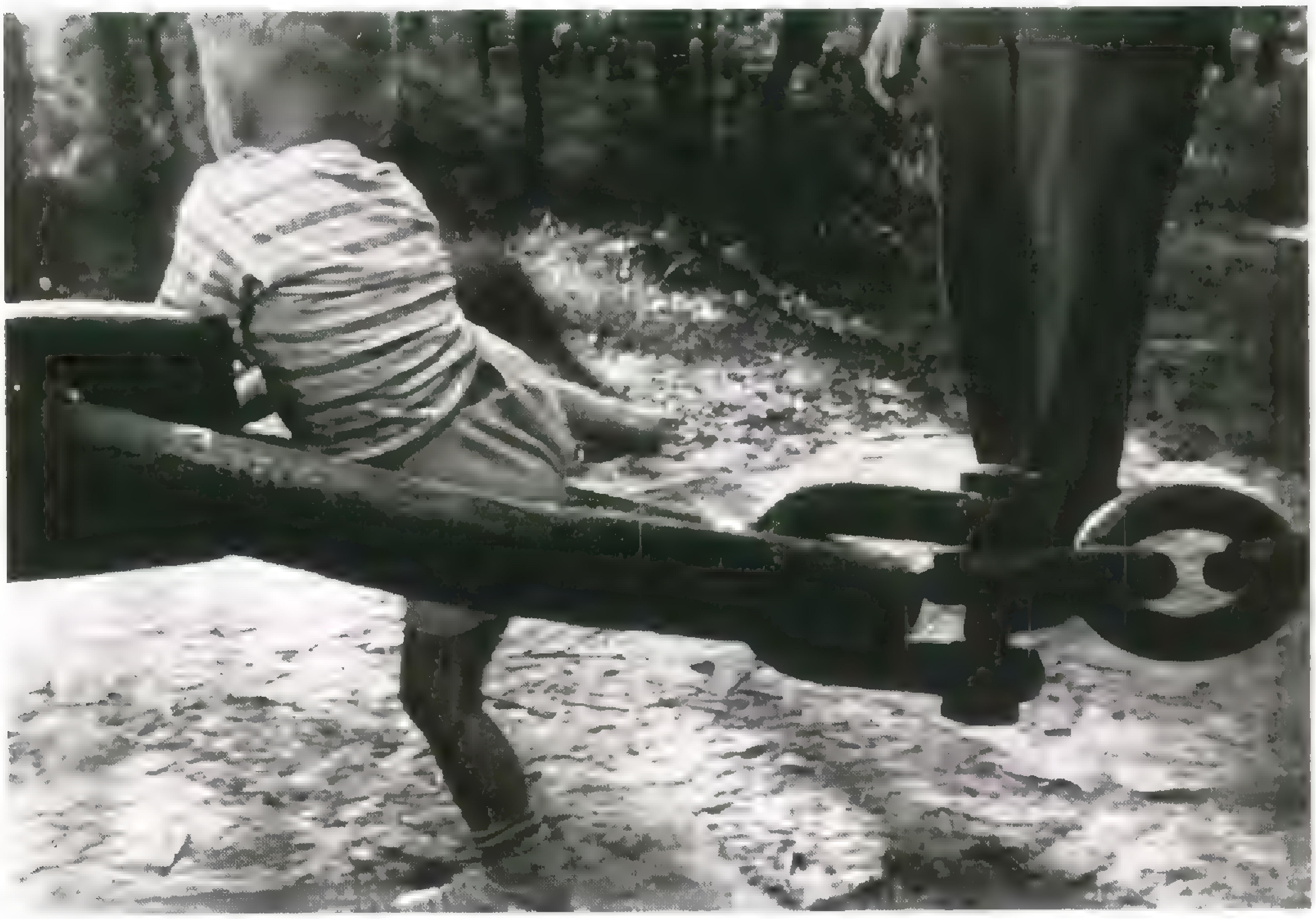
A large American elm, six feet in diameter, grows at Lorimier's grave. Its roots have raised the ground at the base of the tree so as practically to cover a stone by its side.

Don Louis Lorimier was uneducated; he could not write except to sign his name, but he was a man of great information and common sense, and he exerted a powerful influence over the men of his time. He founded Cape Girardeau in 1793. The village was incorporated in 1808, and in 1847 received its charter as a city.

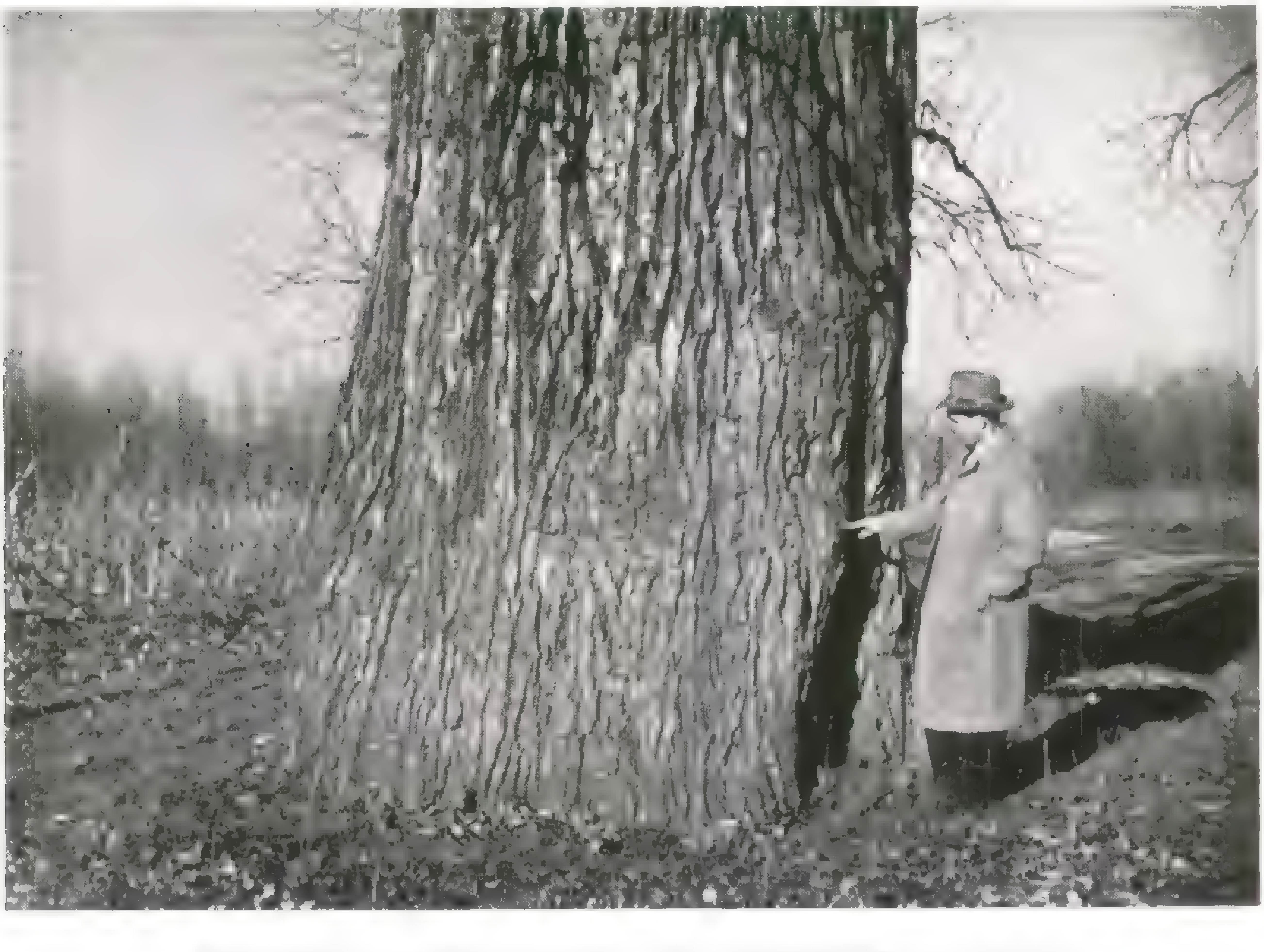
Lorimier died in 1812, but before his death he announced his desire to make provision for the establishment of a public school out of the ample grant of land that was given him by the Spanish government. So after his death, his heirs and legal representatives, in 1820, made a deed conveying forever to public uses certain lots of land, including the one on which the Cape Girar-



THE LORIMIER ELM AT CAPE GIRARDEAU (AMERICAN ELM)



ONE OF THE HAND-FORGED LINKS OF THE CHAIN STRETCHED ACROSS THE MISSISSIPPI IN THE BATTLE OF BELMONT



BELMONT COTTONWOOD OF MISSISSIPPI COUNTY deau High School now stands. This fine site was donated to the cause of education by an unlettered warrior, statesman, jurist, and philanthropist whose visions of the future needs of the town were undimmed by the war whoop of Indians or the greed of traders.

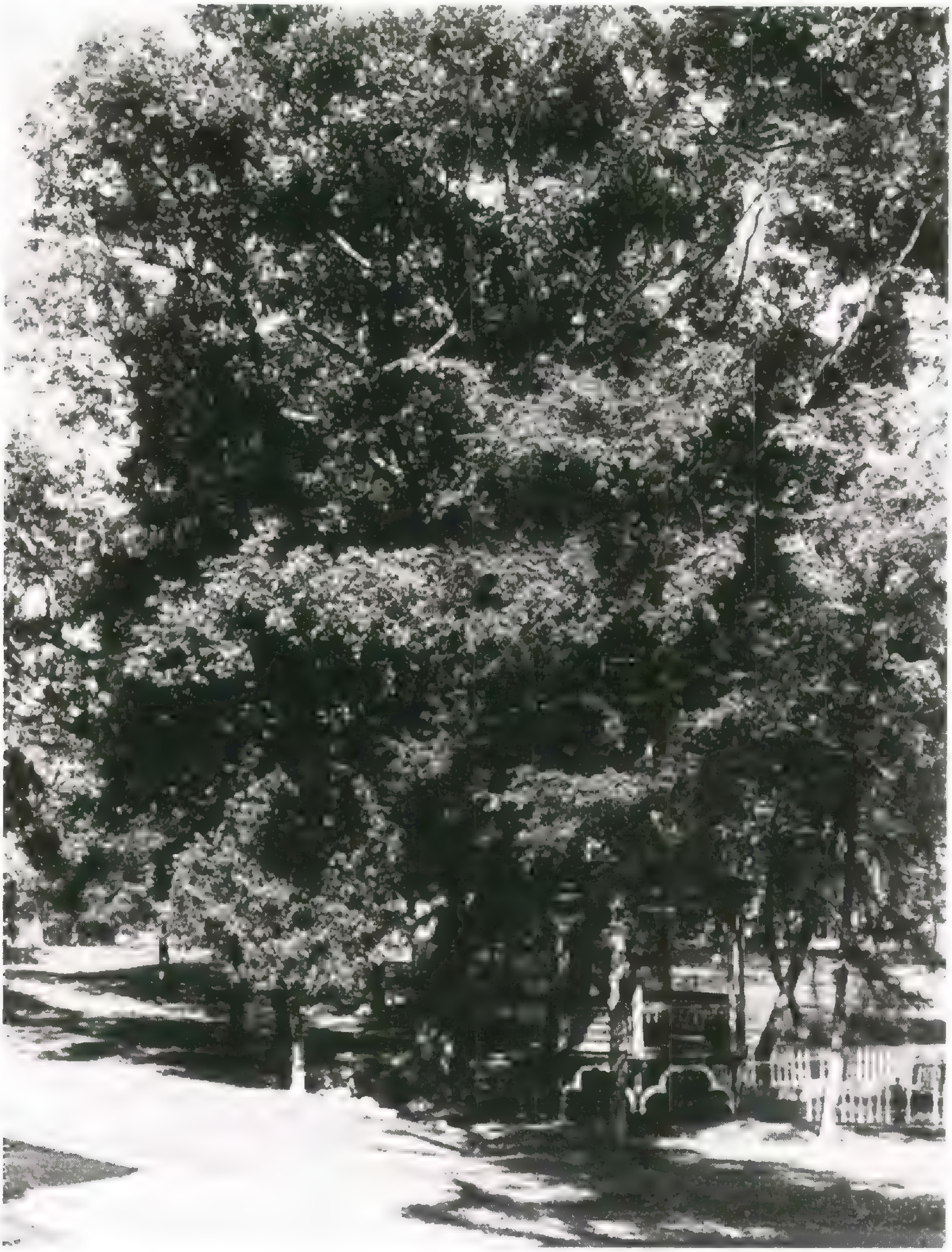
THE BELMONT COTTONWOOD

The Belmont cottonwood of Mississippi County is noted because it marks the locality where Ulysses S. Grant had his first real battle of the Civil War and from which he barely escaped with his life on November 7, 1861. This battle was fought on both sides of the Mississippi River, but the main Confederate entrenchments were on the Kentucky side at Columbus.

A unique factor in this Battle of Belmont was the stretching of a great chain across the Father of Waters during the fortification of the bluffs at Columbus. Approximately 1¼ miles long, composed of 20-pound hand-forged links, with swivels no less light, this mighty chain was swung across the Mississippi on pontoons and tied to a capstan. Incidentally, these pontoons furnished the Mississippi with its first bridge.

Tradition has it that the capstan on the Missouri side was the Belmont cottonwood. On the Kentucky side a 6-ton anchor, 16 feet long with 9-foot flukes, was buried 11 feet to hold the chain. This massive chain, truly a feat of engineering skill, was to act as a barrier to Federal gunboats, so that they might not proceed past this point to threaten Southern strongholds down the river. About the time of Belmont's battle, it is said, a Union gunboat came charging downstream and nosed into the chain. Failing to make passage, the boat backed up and under full steam ahead struck the chain with such force as to break it, thus shattering one of the white hopes of the Confederacy. It is also thought that the chain may have broken because of its own weight; however, the fact remains that here between Belmont and Columbus was employed an artifice unknown to any other fight staged during the war between the states.

Guns at Columbus shooting from across the river, could not be depressed enough to fire directly on the attacking Federals in Belmont, and instead fired into the Missouri trees, shooting off the tops and big limbs. Even today one can plainly see the gap



THE GRANT OAK AT IRONTON, IRON COUNTY (WHITE OAK) in the top of this tree purported to have been shot out by Confederate cannon-fire, and the scar supposedly caused by the chain that was tied around it.

THE GRANT OAK

Three times in its history the little town of Ironton has come into the limelight in connection with Ulysses S. Grant. The first time was in the summer of 1861, when the famous commander, then colonel of an Illinois regiment, made Ironton his headquarters and left it a little later as brigadier general of the U. S. Army. Then, in 1889, survivors of the 21st Illinois Volunteer Infantry erected a granite monument to mark the spot where Grant stood when his commission as general was handed to him. The third occasion was in 1936, when Grant Park, site of his headquarters during the first year of the Civil War, was presented to the Ironton Hospital which is conducted by the Sisters of St. Mary.

Grant Park is a beautiful six-acre tract landscaped with more than 40 varieties of shade and forest trees. In the middle of it, halfway up a slope, is a large spring. It was this spring which led Grant to pick the site for his camp in 1861. Back of the spring stands a 12-room brick mansion built in 1867 where the log cabin used by General Grant had stood.

Every motorist who has driven through Ironton has been impressed by the beauty of Grant Park, and those who stopped had pointed out to them the giant white oak, more than a century old, under which the shy Illinois colonel in his nondescript uniform stood when he was given his commission in the U. S. Army. The Grant Oak, as it was called, was one of the landmarks of the Arcadia Valley, but it died during the past year and was cut down on March 28, 1941.

THE PERSHING COTTONWOOD

Adjoining the 1800-acre John J. Pershing State Park near Laclede, Linn County, and within 100 feet of the park area, is a giant yellow cottonwood estimated to be 150 years old. Its height is 156 feet, with the first branch about 50 feet above the ground. The circumference of the trunk at the base is 22 feet 2 inches. A few years ago the United States Forest Service

PERSHING COTTONWOOD, NEAR LACLEDE, LINN COUNTY stated there was no record of any larger tree of this species in the United States.

This cottonwood tree and military park are memorials to General John J. Pershing whose birthplace and boyhood home was Laclede. It is planned that General Pershing's trophies, now his personal property, and relics in connection with his various campaigns in the Philippines, China, Mexico, and the World War be housed in a museum to be built in this park. Following this, other military flags, banners, and trophies, now in private or government hands, will, in all probability, be added to the collection.

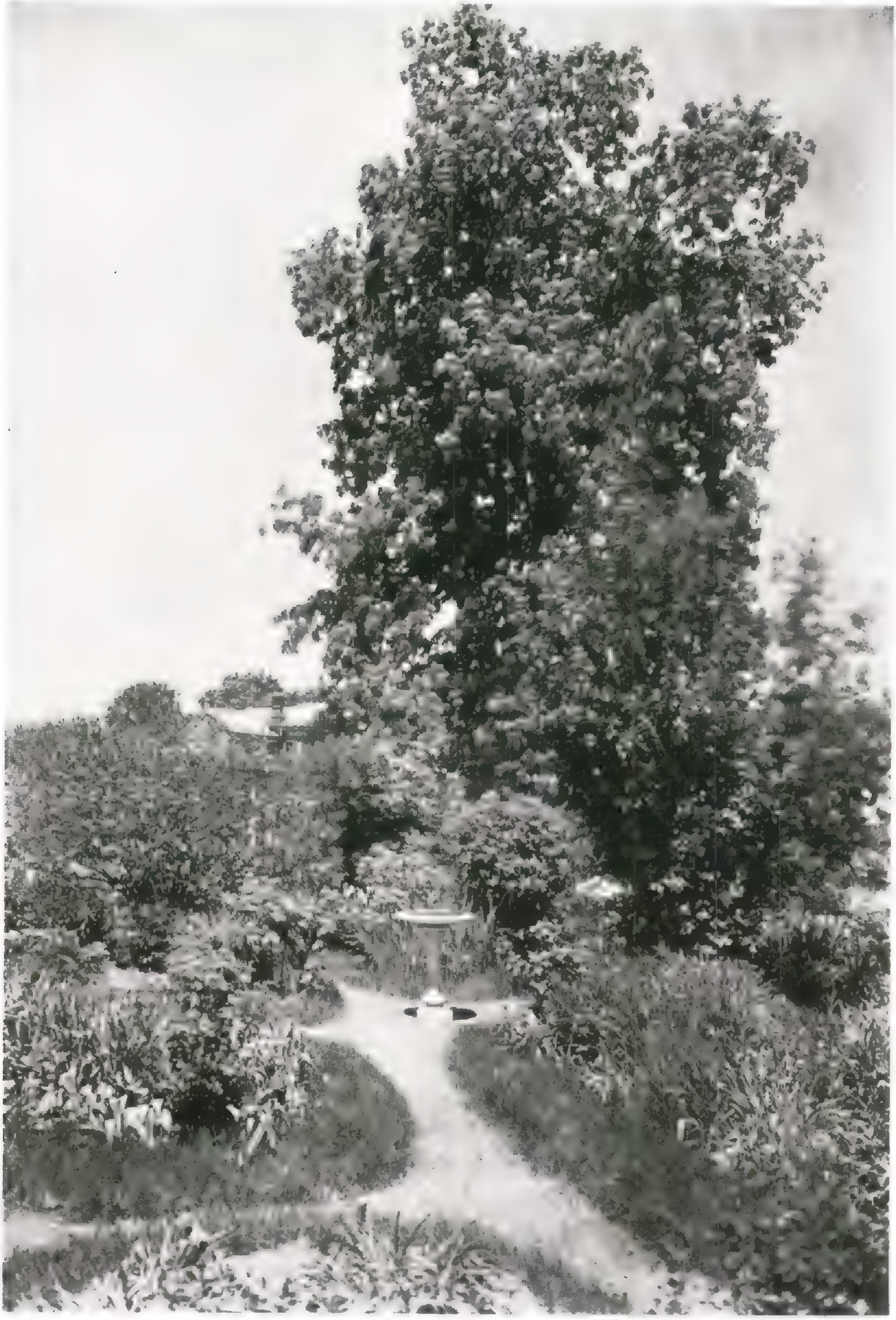
It is hoped that the State Park Board may soon be able to acquire the 20 acres on which the Pershing cottonwood is located.

THE HICKORY COUNCIL TREE

In the garden of the home of Mr. J. Vion Papin at Main and Market Streets, in Ste. Genevieve, stands an ancient hickory tree estimated to be well over 300 year old. Incidentally, this home, known as the "Old House," is the oldest dwelling in Missouri, having been built in 1782, superimposed on the walls of a Spanish fort which was erected between 1734 and 1738.

The tree is strong and sturdy, and, though not the largest, is probably one of the oldest trees in Missouri. It is clothed in ivy which has clung to it from time immemorial. Several years ago it was struck by lightning and the ivy was burned to the ground, but the lightning cured a bad scale condition from which the tree had suffered for a long time.

Numerous legends are connected with this tree. As far back as Indian lore goes, there sat under this hickory a chipper of flint, a craftsman who worked in hard stone fashioning arrowpoints, axes, and spear-heads for his tribe. At the same time he was regarded as a philosopher who dispensed useful knowledge to all. Because of his wisdom and unvarying benevolence, his mat under the hickory came to be venerated as a shrine and finally to be the council seat of chiefs of tribes far up and down the Mississippi. Under this "Council Tree" the calumet was circulated and decisions made which meant war or peace for the Indians. Even the great Pontiac, most astute of all Indian chiefs, is said to have come to this tree seeking advice when on his way



HICKORY COUNCIL TREE OF STE. GENEVIEVE

to Cahokia where he met his death at the hands of a Kaskaskia Indian. Later when the white men came and a commandant, Spanish or French, governed the territory, their meetings with local tribes were held under the "Council Hickory" which stood a few yards from the official residence of the Governor.

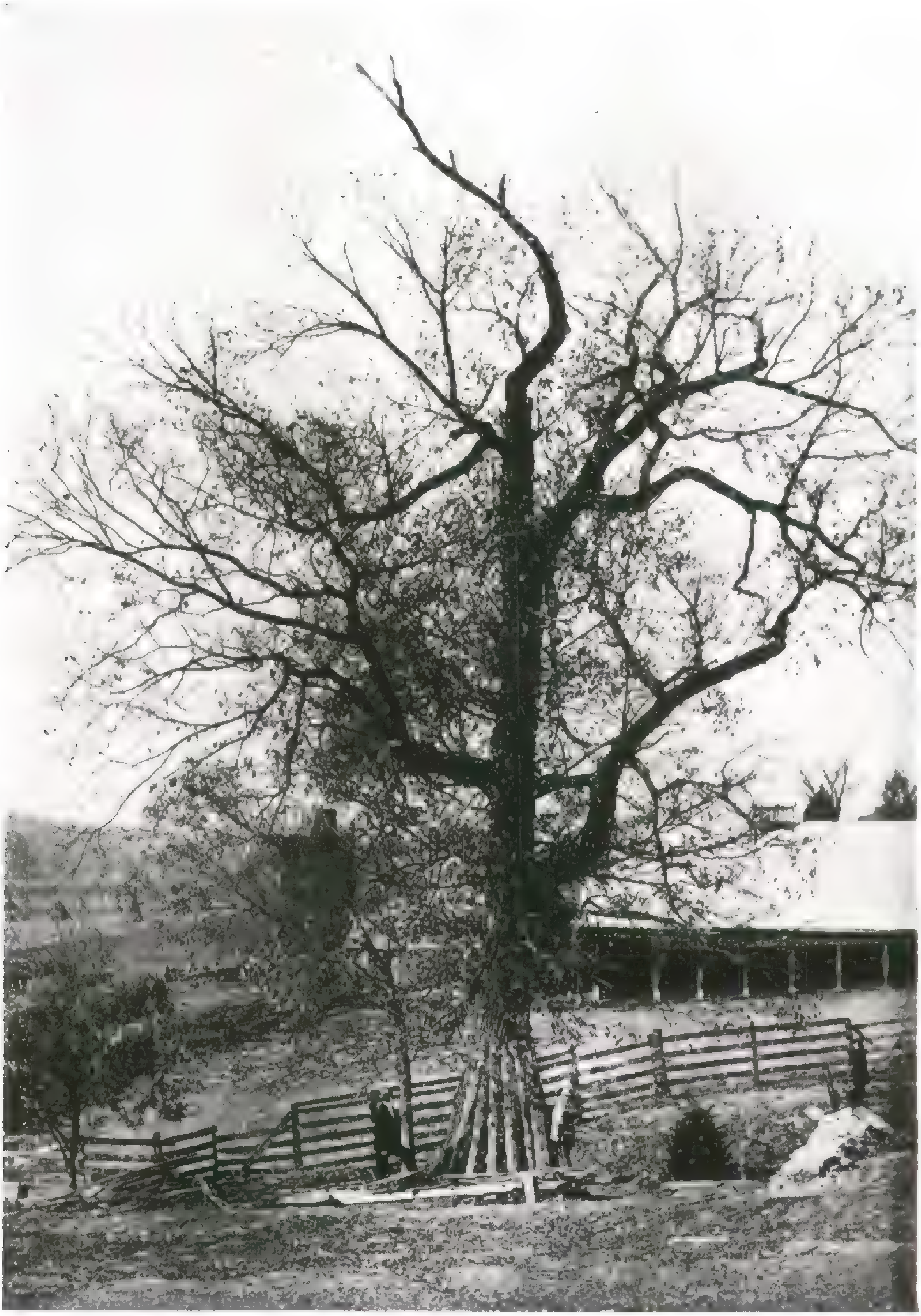
Today concrete evidence of the existence of the skilled craftsman is found in the form of flint chips and arrow-heads uncovered under the tree and about the garden when cultivation is deep or a trench dug.

THE DANIEL BOONE JUDGMENT TREE

In southwestern St. Charles County, about 50 miles from St. Louis, squats the farmstead where Daniel Boone spent his last years. A bit to the west of the stone house is the shed whose rock foundation was used in Daniel's first Missouri home, a log cabin shaped by his own hands. North of the shed is the spring which lured him to select this home site and hard by is the "Judgment Elm" under which he sat as a respected and venerable community judge.

Imagine Daniel Boone, the pioneer sleuthfoot of the Indian paths, sitting in summer in the shade of the mighty tree. He is past 65 years old, a stern-faced powerful-limbed fighter, whose name is known throughout the backwoods. He has come to Missouri, then known as the Upper Louisiana, for more "elbow room." Here we find him, in the year 1800, sitting as a Spanish "syndic," or combined sheriff, judge, jury, and commandant of the district. His decisions, uniformly just, were never questioned. It was as if they had come from the Supreme bench. Boone observed no rules of evidence and followed no case precedents, but said he wished only to learn the truth.

The tree, under whose wide-spreading branches the great backwoodsman sat in dignity whenever the occasion presented itself, is an American elm, 65 feet high, forked about 13 feet from the ground, each branch measuring 9 feet in circumference at the fork. The main trunk is 16 feet 6 inches in circumference 2 feet from the ground. The tree grows on the bank of a shallow ravine about 150 feet northwest of the stone house and about 40 feet south of the site formerly occupied by the log house of Daniel Boone.



THE DANIEL BOONE JUDGMENT TREE (AMERICAN ELM)

THE BIG OAK

Missouri's largest oak, a bur oak or mossy-cup, is located in Mississippi County, 14 miles southeast of East Prairie, in the only remaining growth of massive virgin cypress and oak in this state. This forest covers an area of 31 square miles, and is said to be the largest body of virgin timber in the United States other than that of the Pacific Coast. Thirty-three different kinds of hardwood trees have been counted in this tract.

The age of the "Big Oak" is estimated to be 385 years, which means that it began its life about 1556. When the Pilgrim Fathers landed in New England and founded Plymouth Colony, this tree was 64 years old. It was more than 230 years of age at the time of the signing of the Constitution in 1787. At the present time it towers 128 feet 10 inches, with a height of 47½ feet to the first branch. At one foot above the ground, its circumference is 30 feet 4 inches. Recently a 1000-acre State Park was created around this "Big Oak" of Mississippi County.

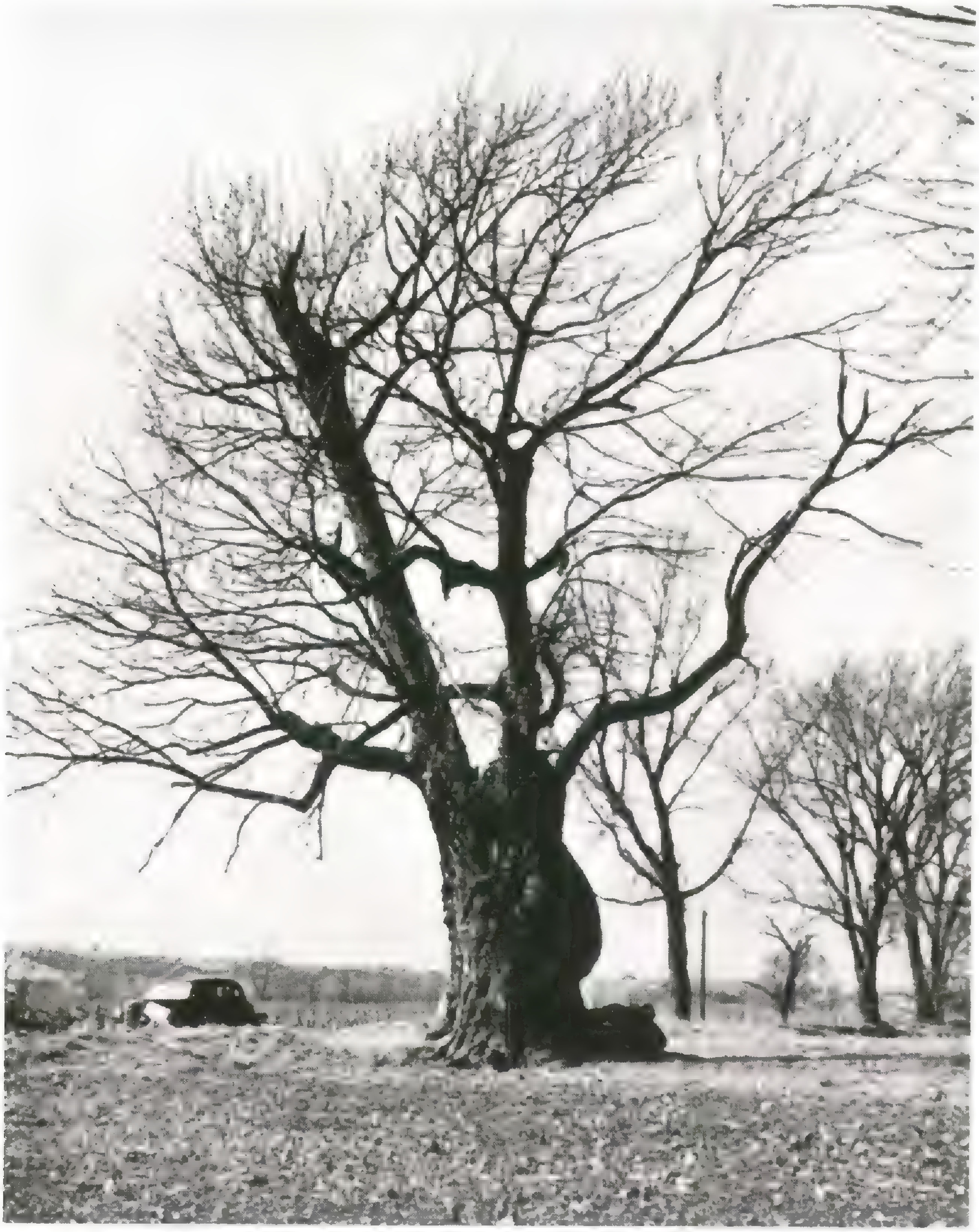
THE BLUE MILLS FERRY MAPLE

In the Missouri River bottoms of Clay County stands a soft maple known as the Blue Mills Ferry Tree. The name was given because of its nearness to the ferry and because of an engagement on September 17, 1861, at Blue Mills Landing, between Missouri State Guards under the command of Colonel J. P. Saunders, and a body of some 1100 Federal troops.

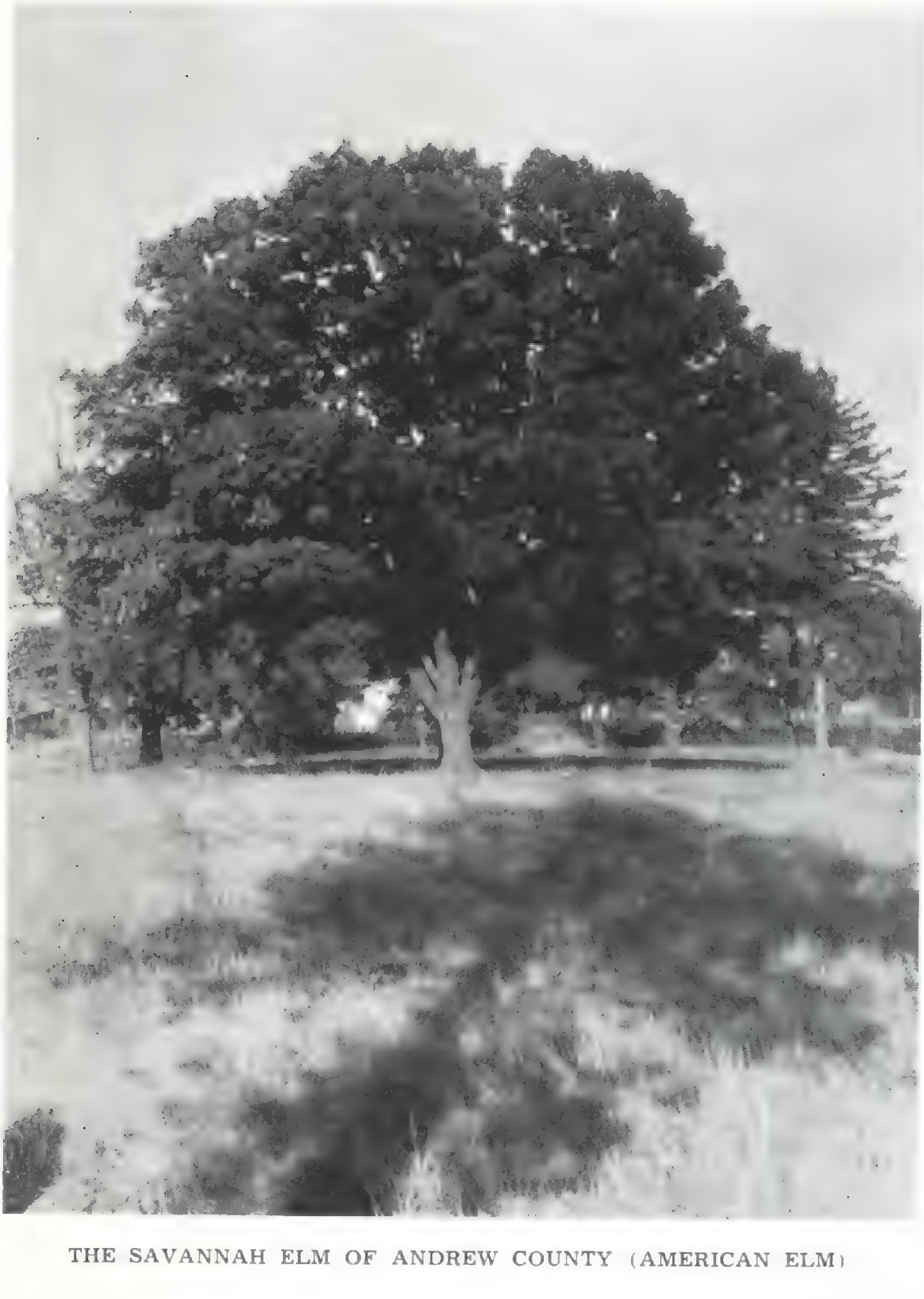
The battle, which was short but fierce, was mostly a running fight and was fought both going and coming along the road under this tree. The fight began in and north of Liberty and continued past this maple to the river. Breastworks were thrown up on the campus of Wm. Jewell College nearby, and Jewell Hall was used as a hospital. The Federal dead were buried on the college grounds and there most of them still lie.

In 1834, a number of years before this battle, the Mormons camped under and around this tree after being driven out of Jackson County in the depths of a very severe winter.

To-day the Blue Mills Ferry Maple is hollow and every storm takes its toll.



THE BLUE MILLS FERRY MAPLE OF CLAY COUNTY (SOFT MAPLE)



THE SAVANNAH ELM OF ANDREW COUNTY (AMERICAN ELM)

THE SAVANNAH ELM

The State of Missouri was twenty years old when the first Andrew County Court transacted its business on March 9, 1841, under the graceful limbs of a large elm on the property of W. C. Henderson on Washington Street north of the Oak Grove addition to Savannah. The tree was of fine proportions and thrifty growth, but the inclemency of the weather soon forced the august assemblage to repair to the private dwelling of Gallant Raines who resided on the premises. The members of this court were Upton Rohner, Samuel Crowley, and William Deakans, with Ezekiel W. Smith as Sheriff.

In 1934 the tree was attacked by insects, and about two years ago it died and had to be cut down. It is to be regretted that this stately elm at Savannah could not have been preserved so that some portion of Andrew County's 1941 Centennial could have been held within the shadows of its branches.

THE TUCKER SYCAMORE

In 1816, there came to this state from Virginia a man of decided ability named Nathaniel Beverly Tucker. Near Florissant, in St. Ferdinand Township, he bought a 321-acre farm not far from the Old Hall's Ferry Road. On his land stood a large, hollow sycamore tree, 8 or 10 feet in diameter. This, Mr. Tucker cut off 8 or 10 feet above the ground, cleaned it out, cut a door in it, put his books around the inside, and lived there as a practicing attorney.

For several years, Mr. Tucker served as a judge of the St. Louis Circuit Court, then went over into St. Charles County, and later became judge of the Northern Circuit in the State of Missouri. He was one of the organizers of the First Presbyterian Church in St. Louis and clerk of the sessions of the Presbyterian Church at Dardenne. He was one of the founders of the Masonic Order in this state and served as its second Grand Master.

About 1833 or 1834, he returned to Virginia to accept the chair of professor of law at William and Mary College. This position he held for about 18 years until his death in 1851. In 1836 Harper Brothers published one of Tucker's most famous books, "George Balcombe," a novel, the scene of which is laid in Saline County, Missouri.

MARYVILLE ELM OF NODAWAY COUNTY (EUROPEAN ELM)

Nathaniel Beverly Tucker was one of the outstanding men of the early St. Louis Bar, but because of his eccentric character he was never popular in his circuit.

What became of his "sycamore law office" no one seems to know!

THE MARYVILLE ELM

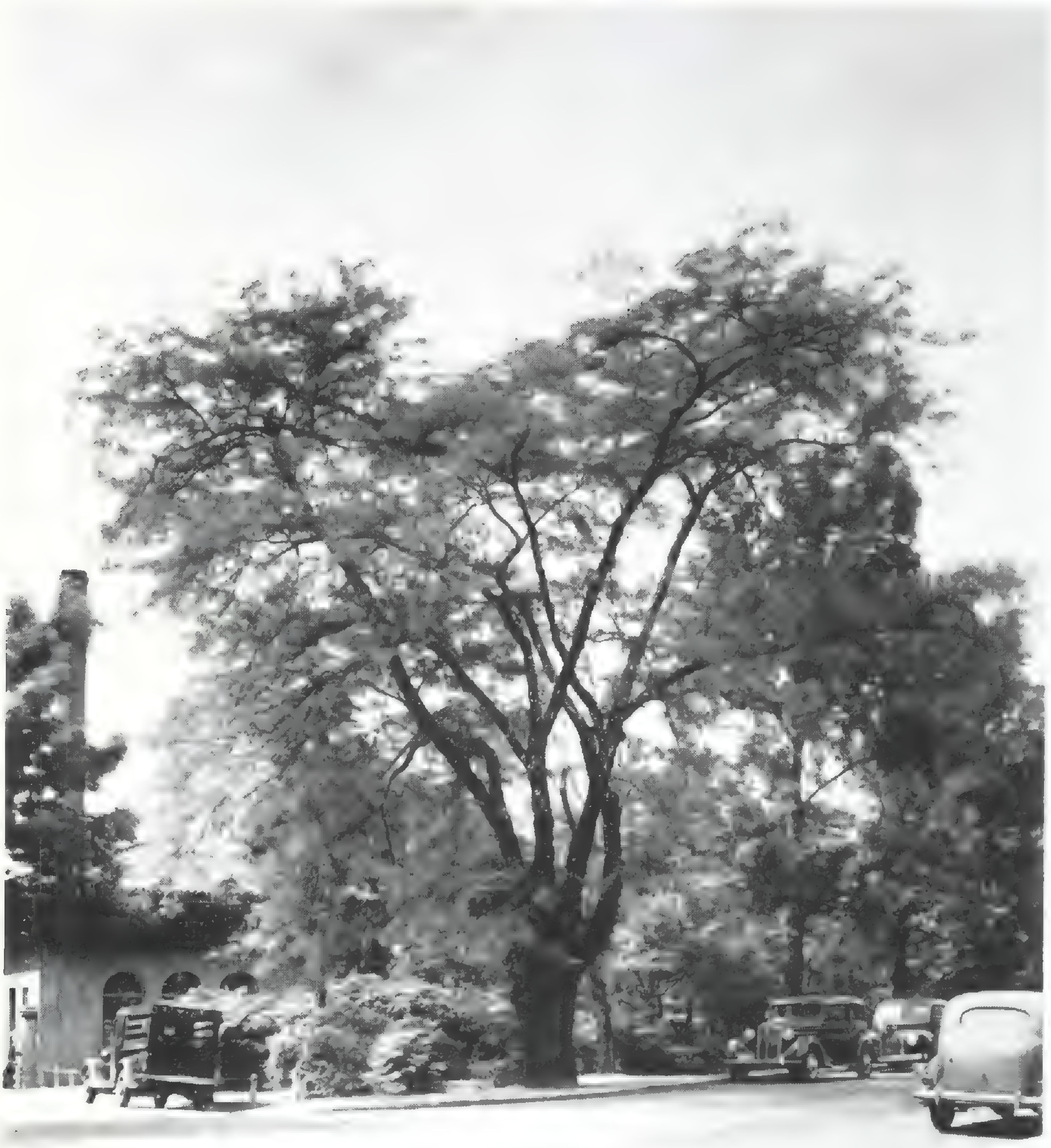
About 7½ miles south of Maryville, on the west side of Highway 71, stands the historic elm of Nodaway County. Under this elm, a group of settlers met in 1845 to organize the County of Nodaway, which is a part of the territory known as Platte Purchase.

One of the first to explore this territory was a wealthy Kentuckian named Colonel Prather. Liking the rich soil, he purchased 3,000 acres and then went back to Kentucky. The following year, 1841, he returned to Missouri, bringing his family, twenty slaves, seed grain for planting, and *a bundle of seedling elms*. He built a log home and planted his seedling elms, some near the house, the rest in two rows from the house to the roadway. The tree that was planted near the milk house is the one that is alive today. *This year marks the one hundredth anniversary of its planting.*

The tree is a variety of elm that is native to southern Europe and eastern Asia. The wood is hard, fine-grained, and not easy to split. Since the top of this tree was severely broken during a tornado a few years ago, its height is about 40 feet. Its circumference at the base is 14 feet. Last year a seedling of this tree was planted in the Maryville Courtyard.

THE BLACK LOCUST OF MUEGGE'S RIDE

During the early evening of Saturday, September 29, 1864, Augustus Muegge, the U. S. Postmaster at Cheltenham, was sitting with his wife and brother in his residence on the New Manchester Road, at what is now the junction with Dale Avenue. The front room of this house, a large two-story brick structure, was occupied by Muegge's General Store and the Postoffice. Several hundred feet south across Manchester Road lay the track of the Pacific Railroad. The place was isolated, there being but three houses along Manchester Road between Muegge's and Grand Avenue.



BLACK LOCUST OF MUEGGE'S RIDE, FOREST PARK

Shortly after dusk, Mr. Muegge was summoned to the front door by a loud knocking. Upon opening the door, he was confronted by a number of men standing on the steps, while others farther back were holding the horses of the party. They asked Muegge about his partisanship and he replied he was a U. S. Postmaster and, therefore, a Union Man. Evidently they expected this reply, for they drove the family from the house. During the ejectment, Muegge observed their gray uniforms beneath their long riding coats, and also their sabers, which convinced him that they were Confederates and not mere guerrillas. While they were seizing the mail, and, incidentally, such articles of merchandise as suited their fancy, Muegge escaped. Securing his horse, he rode with all speed to warn the camp of St. Louis Union militiamen at the head of the Olive Street Plank Road, approximately the present neighborhood of Delmar Boulevard and Taylor Avenue.

His route from his house to the Union Camp was northwardly across lots and pastures up the hill till he reached Clayton Road, then called Fox Creek Road. When he reached a point about where the present stable drive northward from the Forest Park greenhouses reaches Clayton Road, he noticed that his horse was going lame. He dismounted beneath a large black locust tree, removed a rough pebble from his horse's shoe, and then hurriedly rode to the Union Camp. A detachment was immediately sent to Cheltenham, but too late to encounter the hostile party of General Jo Shelby's dashing cavalry.

Today Muegge's building at the intersection of Dale Avenue and Manchester Road has been remodeled as a multiple dwelling, and the Scullin Steel Plant is located in what used to be Cheltenham. The black locust tree of Muegge's ride is still spreading its foliage near the greenhouses in Forest Park and is estimated to be upwards of 125 years old.

THE LONE JACK

In the early days of Missouri, the southeastern part of Jackson County was prairie land with almost no trees. The "Lone Jack" was an exception. It was a great oak standing on a high ridge of the prairie. The Indians used it as a landmark, and camped and held their councils under its branches.

When the trappers came, they recognized it as a black jack oak, and, since the Indians called it the "Lone Tree" in their language, the trappers dubbed it the "Lone Jack." They, too, stopped to rest under its friendly branches as they carried their furs from Big Creek and its tributaries to the Blue River which found its way into the Missouri.

The first settlers took up land in the wooded section and then began to realize that the prairie land was very fertile. A cabin appeared here and there on the prairie, and in 1836 a colony came from Stokes and Surry Counties in North Carolina. One of these Surry Countians, Galen Cave, became the first owner of the land on which the "Lone Jack Tree" stood. Then a village, which was also given the name "Lone Jack," grew up around the oak.

During the late 1850's the tree began to die, and then came the Civil War. The battle of Lone Jack was fought near and around the oak, and when the fight was over, the dead were buried beneath in two long trenches, Confederates in one, Federals in the other. The tree died soon after this, and much of its dead trunk was chipped off by souvenir hunters.

Today a little cemetery, the burying ground of the soldiers, marks the site of this historic black jack oak, the "Lone Jack."

NOTES

Mr. George H. Pring, Superintendent of the Garden, spoke at a meeting of the St. Clair County Garden Club, at Belleville, Ill., September 2, on "The Life of Henry Shaw."

Mr. Ladislaus Cutak, in charge of Succulents at the Garden, gave an illustrated talk "Plants of Old Mexico," before the Cactus and Succulent Club of Chicago, August 28.

Mr. A. P. Beilmann, Arboriculturist to the Garden, has an article in the May-June number of *Trees* (**4**:6, 14, 16) on "Diagnoses of Tree Disorders. No. 2. Possible Use of Instruments."

Dr. Hugh C. Cutler, Research Fellow in the Shaw School of Botany, who is working on Maize and its relatives, spent several weeks at the Garden on his return from Cuba. He has now left for Brazil to continue his research there for a year.

Mr. Walter Flaig, of the Department of Parks, Fort Wayne, Ind., spent the month of August at the Garden, studying the breeding of tropical water-lilies under the direction of Mr. G. H. Pring.

Dr. Edgar Anderson, Geneticist to the Garden, spoke before the Long Island Biological Seminar, July 14, on "Corn and Its Close Relatives," and on July 24, to the Carnegie Institution Journal Club, at Cold Spring Harbor, Long Island, on "The Genetic Analysis of a Species Cross."

Mr. Ladislaus Cutak is the author of "A Word of Appreciation," an article in aftermath of the First National Convention of Cactus Societies held in St. Louis, July 4-5, published in the August *Journal of the Cactus and Succulent Society of America* (**13**:119-120).

The third number of Volume 28 of the ANNALS OF THE MISSOURI BOTANICAL GARDEN was issued in September, and contains the following papers: "A Preliminary Survey of the Genus Tripsacum," by Hugh C. Cutler and Edgar Anderson; "Miscellaneous New Asclepiadaceae and Apocynaceae from Tropical America," by Robert E. Woodson, Jr.; "The Technique and Use of Mass Collections in Plant Taxonomy," by Edgar Anderson; "Mass Collections: *Camassia scilloides,"* by Ralph O. Erickson; "Mass Collections: *Rubus odoratus* and *R. parviflorus,"* by Norman C. Fassett.

BULLETIN articles which have recently been reprinted, either fully or in part, in other horticultural magazines include the following: four plates from "Propagation of Plants," by David C. Fairburn and Paul A. Kohl, in June, July, August and September numbers of *Gardeners' Chronicle of America* (**45**:178, 214, 240, 290); "Living Pebbles and Stones," by Ladislaus Cutak in the June *Journal of the Cactus and Succulent Society of America* (**13**:93-97); "Lightning and Trees," by A. P. Beilmann, in the August *Flower Grower* (**28**:375); "Haworthias Are Not Cacti," by Ladislaus Cutak, in the September *Garden Digest* (**8**:33).

Among the visitors to the Garden during the summer months were the following: Dr. Fred A. Barkley, Instructor in Botany and Curator of the Herbarium, Montana State University, Missoula; Miss Evelyn Bauer, Graduate Student in Botany, University of Missouri, Columbia; Prof. Lewis Clevenger, Professor of Biology, State Teachers' College, Kirksville, Mo.; Dr. Elzada U. Clover, Instructor and Assistant Curator, Botanical Gardens, University of Michigan, Ann Arbor; Dr. Hugh C. Cutler, Research Fellow, Shaw School of Botany; Fr. Arthemè Dutilly, Naturalist of the Arctic Missions and Research Associate in Biology, Catholic University of America, Washington, D. C.; Sister Muriel Flamman, Instructor in Botany, Seton Hill College, Greensburg, Pa.; Mr. Alfred H. Gilbert, District Conservationist in Erosion Control Work, Mayfield, Ky.; Dr. George B. Happ, Professor of Biology, Principia College, Elsah, Ill.; Mr. Roland M. Harper, Geographer, Geological Survey of Alabama, University, Ala.; Dr. E. P. Killip, Associate Curator, U. S. National Herbarium, Smithsonian Institution, Washington, D. C.; Dr. Mary Maxine Larisey, Assistant Professor of Biology, Judson College, Marion, Ala.; Mr. R. C. Mauldin, of the Associated Seed Growers' Inc., San Antonio, Texas; Mrs. R. C. Mauldin, in charge of Seed Laboratory, Soil Conservation Service, San Antonio; Mr. J. L. McMullen, in charge of Biological Sciences, North Idaho Junior College, Coeur d'Alene; Dr. C. V. Morton, Assistant Curator, U. S. National Herbarium, Smithsonian Institution, Washington, D. C.; Dr. Marion Ownbey, Instructor in Botany and Curator of Herbarium, State College of Washington, Pullman; Dr. George K. Parris, Plant Pathologist, Hawaii Agricultural Experiment Station, University of Hawaii, Honolulu; Dr. Elizabeth M. Pinkerton, Medical Mycologist and Allergist, New York City; Prof. C. L. Porter, Head Department of Botany, Purdue University, Lafayette, Ind.; Dr. John N. Porter, Assistant Professor of Botany, University of Puerto Rico, Mayaguez; Mr. Andrew Denny Rodgers III, author, of Columbus, Ohio; Dr. Julian F. Smith, Associate Director, Hooker Scientific Library, Central College, Fayette, Mo.; Mr. T. R. Stemen, Teacher of Biology, Classen High School, Oklahoma City, Okla.; Mr. J. A. Steavenson, of the Soil Conservation Service, Elsberry, Mo.; Mr. Edward Teas, of Teas Nursery, Houston, Texas; Dr. A. G. Vestal, Professor of Botany, University of Illinois, Urbana; Prof. C. E. Wildon, in charge of Floriculture, Michigan State College, East Lansing; Dr. F. Lyle Wynd, Assistant Professor of Botany, University of Illinois, Urbana.

STATISTICAL INFORMATION FOR JUNE-AUGUST, 1941

JUNE

Garden Attendance:

Total number of visitors in June	31,474
Total number of visitors in July	34,043
Total number of visitors in August	41,403

Plant Accessions:

Total number of plants and packets of seeds donated in June	182
Total number of plants and packets of seeds donated in July	206
Total number of plants donated in August	31

Library Accessions:

Total number of books and pamphlets bought in June	6
Total number of books and pamphlets donated in June	233
Total number of pamphlets bought in July	2
Total number of books and pamphlets donated in July	6
Total number of books bought in August	7
Total number of books and pamphlets donated in August	81

Herbarium Accessions:

By Gift—	
Baird, Ralph O.—*Parmelia chlorochroa* Tuck. from New Mexico	1
Cory, V. L.—*Tripsacum dactyloides* L. from Texas	1
Erickson, Ralph O.—Photographs of types of *Clematis*	20
Fulford, Margaret—*Thysananthus Evansii* Fulford from British Honduras	1
Gilbert, Frank R.—*Iris virginica* L.? from West Virginia	1
Hubricht, Leslie—Plants of southern and southeastern United States	507
James, Leslie—*Saururus cernuus* L. from Alabama	1
Runyon, Robert—Plants of Texas	6
By Exchange—	
Arnold Arboretum, Harvard University—Plants of Louisiana and North Carolina	73
Hermann, F. J.—Plants of Virginia, Delaware, and Maryland	41
Total	652

JULY

By Gift	
Bauer, Mrs. M.—*Sabbatia angularis* (L.) Pursh from Missouri	2
Buchholz, John T.—*Podocarpus gracilior* Pilger from Horticulture	1
Cory, V. L.—Plants of Texas	4
Hubricht, Leslie—Plants of South Carolina, Florida, Alabama, and Missouri	18
James, Leslie—Plants of Alabama	3
Starkey, Mrs. W. J.—*Eustoma Russellianum* Griseb. from Texas	1

By Exchange—	
University of California—*Algae*	169
University of Kentucky—Plants of Kentucky, Century I, Nos. 1-100, inclusive	100
By Transfer—	
Fairburn, D. C.—*Tradescantia* sp. from Horticulture	1
Pring, George H.—*Bulbophyllum breviscapum* J. J. Smith from Horticulture	1
Total	300

AUGUST

By Purchase—	
Lundell, C. L.—Plants of British Honduras and Mexico	100
Williams, L. O.—Orchids of Mexico	200
By Gift—	
Bracelin, Mrs. H. P.—*Mandevilla* sp. from Ecuador	1
Clemens, Mrs. M. S.—Plants of New Guinea	19
Cutler, Hugh C.—Plants of Nevada and Cuba	5
Keever, Miss Catherine—Lichens of North Carolina	6
U. S. National Museum—*Peltigera* sp. from Virginia	1
University of Michigan by C. L. Lundell—Plants of British Honduras and Mexico	10
Williams, L. O.—Plants of Mexico	2
By Exchange—	
Demaree, Delzie—Plants of Arkansas	1,965
De Pauw University—*Cuscuta* sp. from Texas	2
Gray Herbarium, Harvard University—Plants of San Domingo	70
Williams, L. O.—*Scaphyglottis pumila* Ames, from Mexico	1
By Field Work—	
Cutler, Hugh C.—Plants of Cuba	4
Woodson, R. E., Jr.—Plants of Panama collected by Paul H. Allen, and by R. E. Woodson and R. W. Schery	1,590
Total	3,976

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Field Museum Notes

For sale by the Missouri Botanical Garden. Price $3.00

MISSOURI BOTANICAL GARDEN BULLETIN

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SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date to the death of Mr. Shaw, in 1889, the Garden was maintained under the personal direction of its founder, and while virtually a private garden it was, except at certain stated times, always open to the public. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was designated by Mr. Shaw as its official title and in his will and all of his writings he specifically referred to it as the "Missouri Botanical Garden." By a provision of Mr. Shaw's will the Garden passed at his death into the hands of a Board of Trustees. The original members of the Board were designated in the will, and the Board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provison of the will, the immediate direction of the Garden is vested in a Director, appointed by the Board of Trustees. The Garden receives no income from city or state, but is supported entirely from funds left by the founder.

The city Garden comprises 75 acres, where about 12,000 species of plants are growing. There is now in process of development a tract of land of over 1,600 acres outside the city limits which is to be devoted to (1) the propagation and growing of plants, trees, and shrubs, designed for showing either indoors or outside, at the city Garden, thus avoiding the existing difficulties of growing plants in the city atmosphere; (2) gradually establishing an arboretum as well as holding a certain area as a wild-flower reservation, with the idea that possibly at some future time this may become the new botanical garden.

The Garden is open to the public every day in the year except New Year's Day and Christmas—week days from 8:00 a. m. until sunset; Sundays from 10:00 a. m. until sunset. The greenhouses are closed every day at 5:00 p. m.

The main entrance to the Garden is located at Tower Grove Avenue and Flora Place, on the Sarah car line (No. 42). Transfer south from all intersecting lines. The Garden may also be reached by the Tower Grove bus (No. 21).

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1. *Phoenix canariensis* (Canary Islands Date Palm). 2. *Arecastrum Romanzoffianum* (Feathery Coconut) at St. Leo College. 3. *Acrocomia totai* at St. Leo College. 4. Avenue of *Roystonea regia* (Royal Palm) at Fort Myers.

Missouri Botanical Garden Bulletin

Vol. XXIX OCTOBER, 1941 No. 8

A TRIP TO THE LAND OF SWAYING PALMS

Geologically speaking, Florida is very young, probably the infant among the forty-eight states of the Union. Most of it rests on the coral foundations laid down by tiny marine polyps ages ago. No other state offers such contrasts and such a wide variety of plants, and some of them are not to be found anywhere else in continental United States. An ecological survey discloses pine-lands, flat woods, dry prairies, scrub-lands, salt flats, cactus thickets, palm savannas, hammocks, swamps, beaches and dunes. Nowhere in the state are there mountainous areas, as no part of it rises more than 500 feet above sea level. However, through the center of the state lies a range of softly rounded and lake-studded hills. Within this section are grown most of Florida's grapefruit, oranges and tangerines, extending over an area of more than 300,000 acres.

Northern Florida, particularly the central section, is much like southern Georgia. Pine-lands are conspicuous, and cleared sections are given over to corn, cotton, tobacco, peanuts, forage crops, vegetables and fruit products. Entering the state from Valdosta, Georgia, the first important town encountered is Lake City, gateway to the Osceola National Forest, where a battle of the Civil War took place. About 50 miles southward lies the bustling town of Gainesville, the home of the University of Florida. A few hours were spent wandering about the grounds of the Agricultural Experiment Station, viewing the sub-tropical trees and shrubs, which, although hardy here, have to be grown under glass at the Missouri Botanical Garden. It was surprising to note how many of these plants were capable of living outdoors in northern Florida, which is subject to quite heavy frosts. A good selection of native and exotic palms was represented on the grounds of the Station, the hardiest members being *Sabal minor, S. Palmetto, Rhapidophyllum hystrix, Serenoa repens, Butia capitata, Phoenix canariensis, P. sylvestris, Chamaerops humilis, Livistona chinensis, Trachycarpus Fortunei, Washingtonia filifera* and *W. robusta.* Some of the palms were injured by the prolonged cold spell of last winter but most of them revived after about three months.

Beside the palms there are a number of tropical and sub-tropical trees and shrubs for trial in the experimental plots. Some can endure a few degrees of freezing if it is not of long duration. Others, if given protection for the first few years, can be grown without further attention, unless there is a very severe freeze which may occur at rare intervals. The Natal Plum, Mexican Apple, Loquat, Surinam Cherry, Pineapple Guava, Common Banana, Pomegranate, and Jujube can all be grown around Gainesville. The original Tung-oil trees introduced into this country are still growing in a grove and at the time of our visit were heavily laden with fruits. The oil derived from the nuts is used in the better grades of paint and varnish. Several Tung-oil groves are thriving in Alachua County and other sections of Florida.

At the Experiment Station we got our first view of a hammock, a peculiar type of vegetation typical of Florida. Hammocks are dense primeval forests of broad-leaved trees, as distinguished from pine woods. Abundant humus litters the floor, and tall straight trees festooned with innumerable vines or "lianas" make passage almost impossible.

Following the main highway through central Florida we arrive at Ocala, starting-point for the trip to the famous Silver Springs, one of Florida's most beautiful natural wonders. The Timuquas, early Indian inhabitants of northern Florida, worshipped at this crystal clear spring which gushes from a vast cavern at the bottom of a circular basin. Glass-bottomed boats ply over the waters, revealing the underwater life on the multi-colored canyon walls.

Midway between Ocala and Leesburg lies the beautiful Lake Weir, bordered by stately pines and lying amidst country dotted with fine orange groves. The excellent highway winds over the

PLATE 41

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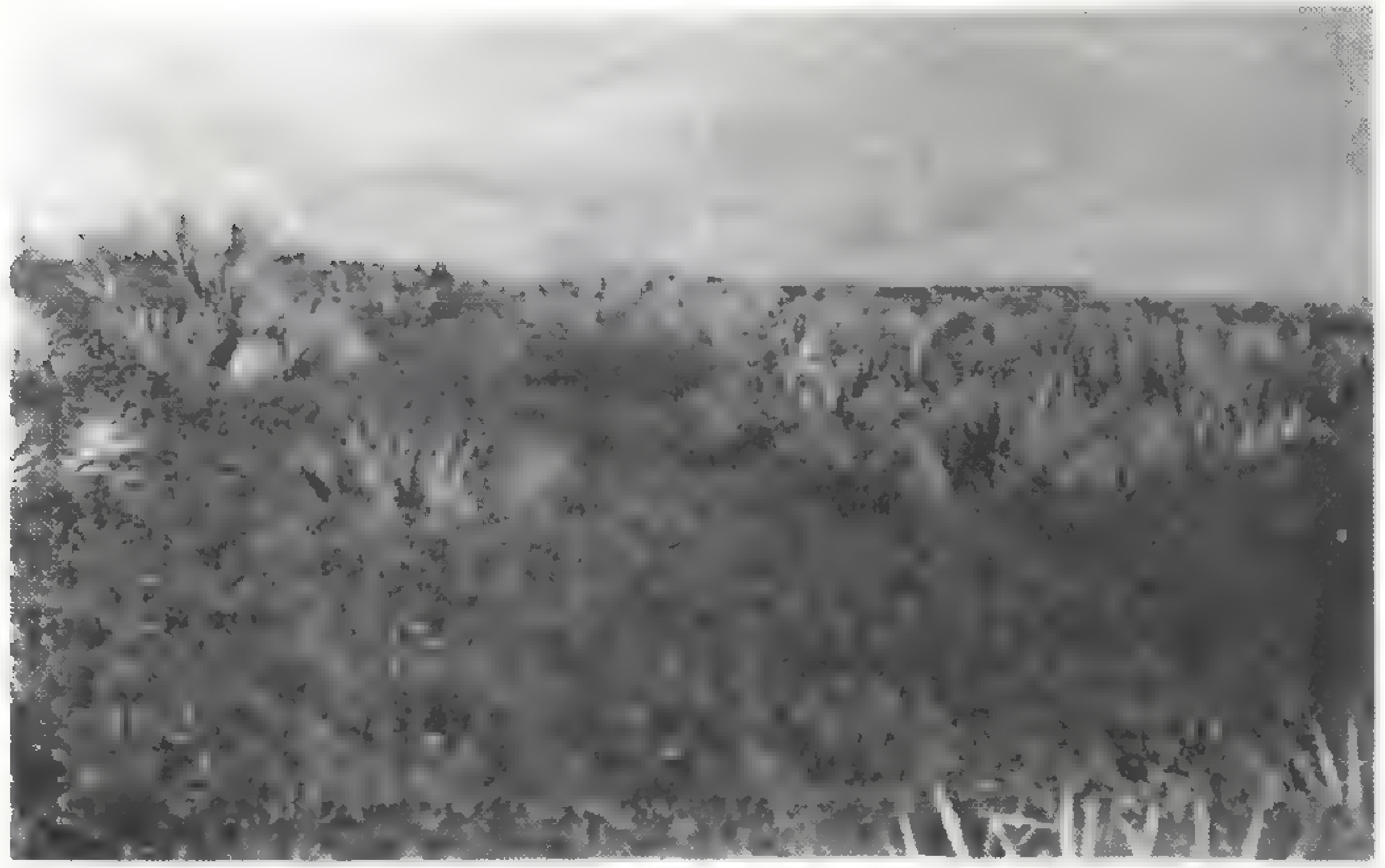

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1. Lily pools at McKee Jungle Gardens. 2. Moss-draped Cypress at Florida Cypress Gardens. 3. Thicket of Saw Palmetto *(Serenoa repens)* north of Riviera. 4. Bob Mitchell and his Caladiums at the Shore Acres Nursery, Orlando.

rolling hills and drops down to Orlando, a town nestling in semi-tropical verdure. More than thirty lakes lie within the city.

On the outskirts of Orlando we visited the Shore Acres Nursery, operated by Bob Mitchell, who received his vocational training at the Missouri Botanical Garden. At his invitation we made our headquarters on the premises and were treated royally. The nursery, which is located on the shores of beautiful Lake Jessamine, makes a specialty of fancy-leaved Caladiums, although other ornamentals are likewise grown. On the ten-acre estate many interesting sub-tropical trees and shrubs are thriving. A verbenaceous shrub, *Duranta repens,* struck my fancy because it was copiously covered with small globular yellow berries, while at the same time it was producing lilac-colored flowers in loose racemes. The bignoniaceous climber, *Allamanda cathartica* var. *Hendersonii,* unfurled its golden trumpets. Because of its long blooming period and vigorous habit this ornamental has become a great favorite in central and southern Florida. The Pindo Palm was heavily burdened with strongly aromatic tasteful fruits about the size of ordinary egg-yolks. Botanically the palm is known as *Butia capitata* and hails from southern Brazil and Paraguay.

From Orlando the westward trail beckoned to Gotha, a town of sacred memories. Here in his "Palm Cottage Gardens" toiled Dr. Henry Nehrling, one of Florida's best-known plantsmen. For 43 years he studied and experimented with tropical and sub-tropical plants of all kinds and left a fund of precious knowledge concerning them.

Continuing on our way, the highway skirts several picturesque lakes before we reach Bushnell, where the horrible Dade Massacre occurred in the Indian wars. About 30 miles southward, beside Lake Jovita, nestles the Benedictine school dedicated to St. Leo. Here we met Father Jerome, a soft-spoken monk who for many years has been a collector of tropical plants and a keen student of Nature. In 1915 he sent the Missouri Botanical Garden a plant of *Washingtonia robusta* which is now 16 feet tall, and on numerous other occasions he has donated interesting plants.

When Father Jerome first came to St. Leo College twenty-five years ago he tried to establish a representative collection of palms on its grounds. He has planted about 150 varieties, but the cold weather of Pasco County interfered and many rare specimens

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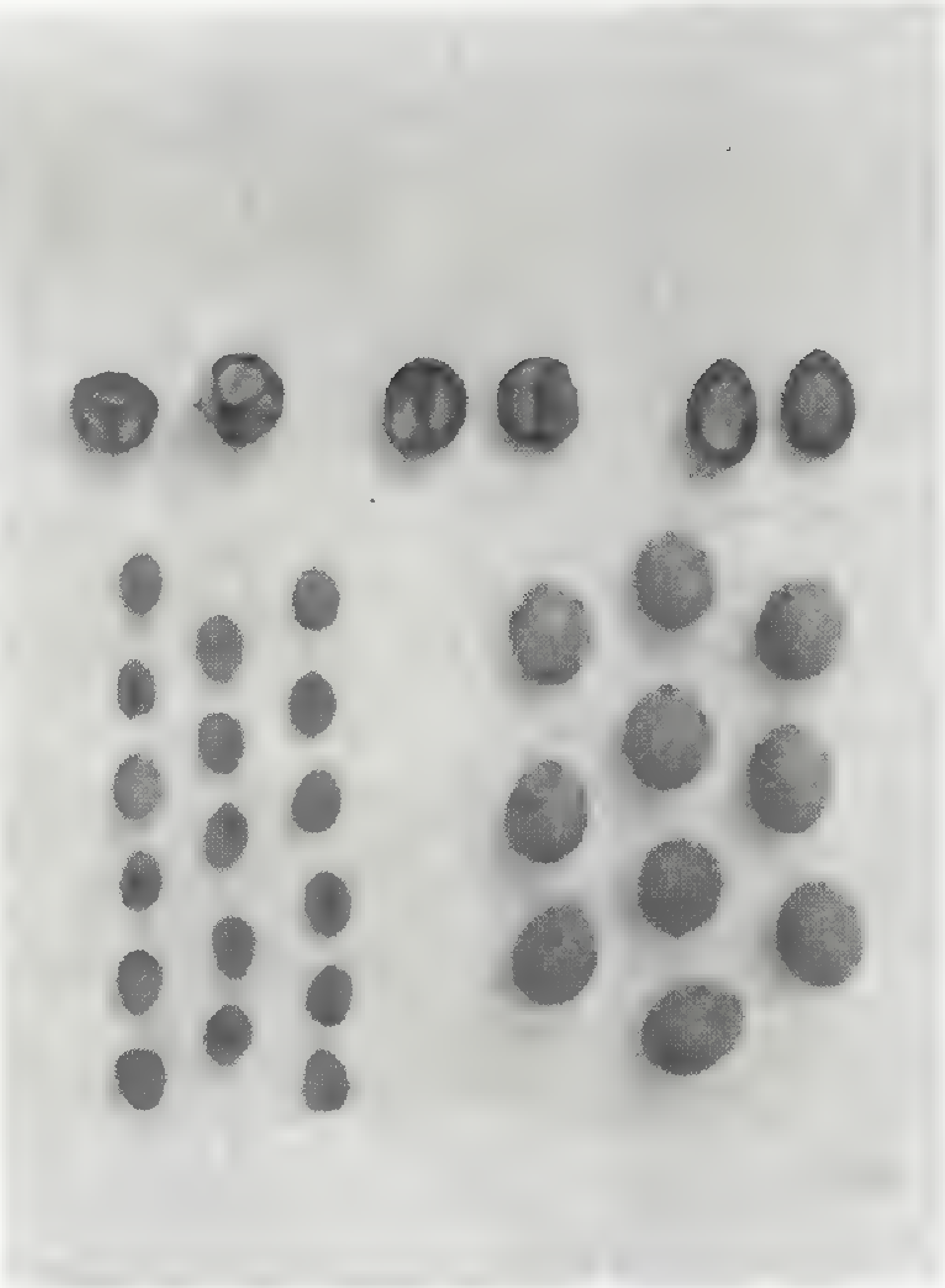

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1. Fruiting Pindo Palm *(Butia capitata)*. 2. Seed story of the Pindo Palm. 3. *Microcycas calocoma* at Colonel Robert Montgomery's estate. 4. *Crinum giganteum* at McKee Jungle Gardens.

were lost. At present about 200 specimen palms are still to be seen on the grounds, distributed among a dozen or perhaps fifteen species. The Canary Islands Date *(Phoenix canariensis)* is one of the most picturesque with graceful pinnate leaves forming an immense hemispherical crown at the top of a massive trunk. The feathery Coconut Palm *(Arecastrum Romanzoffianum),* more commonly known as *Cocos plumosa,* is widely planted in Florida because it is quite cold-resistant and has a far greater range of adaptability than any of the other tall graceful palms. Probably the finest display of *Acrocomia totai* in Florida is contained in the avenue leading to St. Edward's Hall. Father Jerome planted these beautiful feather-leaved palms nearly a quarter of a century ago and is very proud of them. The trunks tend to bulge above the middle and are armed with long, stiff, black spines.

Reluctantly we left St. Leo's hallowed ground and headed southward once more, our destination Winter Haven and the alluring Florida Cypress Gardens. Less than a decade ago the shores of Lake Eloise were a tangle of unsightly marsh growths. Century-old Cypress trees, with their curious "knees," extended far out into the waters. Richard Pope owned some of this land, and with rare imagination he foresaw the beauty that lay dormant in his ugly swamp. Gradually plans began forming in his mind and ultimately these took shape on paper. Soon workmen were clearing the shore-line, canals were built, islands formed, paths laid out, undesirable weeds were dug up and replaced with exotic flowering plants. In January, 1935, the great dream of Mr. Pope became a reality, and today it is enjoyed by thousands upon thousands of visitors.

At the Cypress Gardens again I came in contact with tropical plants which are treasured in our own glass-covered jungle at the Missouri Botanical Garden. The Mexican *Monstera deliciosa* clasped the trunks of tall trees with a vise-like grip, while *Pothos aureus,* another tropical climber, clothed its host with a colorful robe of large yellow and green striped leaves. The flame-spattered Ixoras and the brilliant Hawaiian Hibiscus lit up shaded nooks, and the Peruvian *Tibouchina semidecandra* spread a royal mantle of intense blue over the dark green foliage. Silent electric boats glided over the tranquil waters, passing under rustic bridges and bringing into view flower-studded recesses and jungle hideouts which are impossible to be seen along the cypress block paths that wind through the Gardens.

Nightfall found us across the broad Caloosahatchee River at Fort Myers, the town that is commonly referred to as the "City of Palms." Here the truly tropical aspect of the country makes its appearance. Stately Royal Palms *(Roystonea regia)* spread their bright green crowns above the house tops, brilliant Bougainvilleas clamber over walls and roofs, and the dainty *Antigonon leptopus* reaches for the tallest trees to suspend its attractive festoons of coral-pink flowers.

South of Fort Myers several miles of sandy pine-land are encountered, interrupted here and there by another type of vegetation known as "the scrub." Willow oaks, scrub oaks, dwarf oaks and spruce pines are characteristic of this area. Beyond Naples lies the Big Cypress Swamp, in whose marshy interior live the Seminole Indians. A number of their camps are scattered along the picturesque Tamiami Trail. Often one will catch glimpses of the Indians as they pole their peculiar cypress dugout canoes through the water hyacinth-filled canals.

Adjoining Miami on Biscayne Bay is the residential suburb of Coconut Grove. Here we were invited to roam on Colonel Robert Montgomery's estate, which is a veritable botanical garden. There are 75 acres in the tract, approximately 50 acres cleared and planted. After Mr. A. C. Jordahn, the superintendent, had guided us over the place he took us to the nearby Fairchild Tropical Garden. This garden contains some 80 acres, 25 of which are reserved for the Montgomery Palmetum. Colonel Montgomery has owned the estate for the past eight years, during which time he has purchased as many species of palms as were to be found throughout Florida and also secured seeds from all over the world. Well over 500 species of palms and cycads are represented. It is surprising what rapid growth some of the palms make if given a chance.

Among the most prized palms are some specimens of Attalea with leaves which sometimes attain a length of 50 feet. Scheelea does particularly well and seems fairly hardy. Several trees of *Guilielma utilis* have fruited but the fruit developed poorly. The tall, slow-growing, fan-leaved *Corypha elata* and the Hyphaene are among the rarer palms. Several Acrocomias, a large number of various Sabals and a very good representation of native Florida palms make the collection outstanding. Beside the palms, the cycads are very well represented. Most of the large ones were imported from their native homes and include several Australian, many South African, Mexican and Cuban species. I am fairly well acquainted with the cycads, for we have a fine collection at the St. Louis garden, but here I came across the rare *Microcycas calocoma* which hails from the mountains of western Cuba. The root of the "palma corcho," as it is known in Cuba, is used by the natives as rat poison.

A visit to Florida would not be complete without a stop at the world-famous McKee Jungle Gardens, located along U. S. Highway One, three miles south of Vero Beach. This garden is unique among the gardens of the world. It is not only a botanical garden but an animal preserve as well, for hundreds of monkeys and other animals have been collected in all the corners of the world. Winding pathways traverse the 80-acre "wilderness," and from numerous vantage points one is able to get the feel of the mysterious depths. Thousands of tropical plants line the trails, orchids suspend their gorgeous blossoms from the crotches of trees, vividly colored flower-brushes protrude from the centers of the bright green bromelias, and delicate Anthuriums grace the shaded corners, growing on old stumps and fallen logs. Brooklets wind through the undergrowth, their banks lined with feathery ferns and semi-aquatic plants. *Crinum giganteum* unfurls its large, white, fragrant bell-shaped blossoms beside an inky pool. Shrubs of blooming Hibiscus add a touch of South Sea Island magic.

L. C.

BOTANICAL GARDENS YESTERDAY AND TODAY

Francis Bacon, the philosopher, said more than 300 years ago, "God Almighty first planted a Garden and indeed it is the finest of humane pleasures." So ever since man began to organize plants of the earth, there have been botanical gardens of one sort or another. Apparently from earliest times, men tried, by establishing gardens of greater or less proportions, to materialize their dreams of the original paradise.

The Emperor Shen Nung, 2800 B.C., regarded by the Chinese as the father of husbandry, is reported to have had a garden in which he grew plants of medicinal value, and Thothmes III, who lived in Egypt about 3,000 years ago, had a pleasure garden planned by the head gardener of the Temple of Karnak. So the history of gardening, at least as an art, is probably contemporaneous with the history of man.

The cultivation of plants for their healing qualities, by the monks of the Middle Ages, appears to have been responsible for the origin of the modern botanical garden, although these medieval gardens were based on others of even greater antiquity. While the aesthetic use of flowers and plants doubtless appealed to those who visited these early gardens, it seems quite clear that so-called botanical gardens were primarily for the purely utilitarian purpose of growing and studying medicinal plants. Recognized gardens thus had their origin in the need of protecting the doctor and apothecary against unprincipled "drug-sellers" who could not be relied upon to furnish the proper plants from which the remedies were to be prepared. The functions of a botanical garden as aids in scientific teaching and research did not develop much, if at all, prior to the middle of the 17th century.

The taste for plants for ornamental and decorative purposes slowly increased as well as the desire to possess rare and unusual forms, so that by the middle of the 18th century this feature of public gardening attained considerable prominence. Persons of wealth and influence fostered the idea, and, through the employment of men skilled in botany and horticulture, became generous patrons of science. The world was searched for new and rare specimens to be brought home for cultivation, and many magnificently illustrated volumes were published by these wealthy lovers of flowers.

While the older gardens were essentially private institutions, as the rights of the people became more and more recognized many existing establishments and an increasing number of new ones were opened to the public.

To botanical gardens have been added a number of functions which have developed slowly, not appearing simultaneously. Beginning with the purely utilitarian idea, the aesthetic, the scientific, and the educational have been gradually evolved. These functions have been given different degrees of prominence, depending chiefly on local conditions; some gardens being essentially aesthetic, some mainly scientific, and others combining in various proportions all the elements mentioned. The modern tendency is to make of a botanical garden something more than a museum of living plants, for however necessary this may be it is apt to be uninteresting to anyone but the specialist, and lacks appeal for a large majority of the public.

Dr. Liberty Hyde Bailey, the dean of American horticulture, has set forth the purposes of a botanical garden as follows:

1. To popularize plant knowledge directly.
2. To conserve the native plant life of the region.
3. To preserve historic plants and species and varieties.
4. To introduce new species to cultivation.
5. To train gardeners.
6. To supply an adjunct to the schools.
7. To maintain research.
8. To publish.
9. To cooperate with other similar institutions and agencies for the extension of botanical and horticultural knowledge.

It is interesting to compare this list with the provisions of Mr. Shaw's will. Practically every one of the activities indicated by Professor Bailey as being essential for a real botanical garden was either specifically mentioned or anticipated. Certainly at the present time it can be safely said that the generosity and wisdom of Henry Shaw have made it possible for the Missouri Botanical Garden to perform all the functions mentioned by Professor Bailey, with the addition of certain ones not mentioned by him.

The principal botanical gardens in this country, as well as those abroad, are either connected with some institution of learning or are maintained wholly or in part by the municipality or the government. In this respect the Missouri Botanical Garden is unique, since it has no connection with the city or state, deriving all its support from the income of the Henry Shaw estate.

While the various activities of an institution like the Garden are not easily classified they may roughly be grouped under the five headings: Publication, Research, Instruction, Collection, and Exhibition.

Publication: If the work done at the Garden is to be of any use, there must be some means of letting those interested know about it. For this purpose there are two publications of very different sorts. One, the BULLETIN, attempts to give an account in popular language of what goes on at the Garden, of special interest to the amateur. The other is the ANNALS, a quarterly journal devoted to the scientific work of the staff and students. It is technical in character and is sent to all sorts of scientific institutions over the world. The scientific reputation of the Garden is based upon the work recorded in the ANNALS.

Research: Research means searching again and again to find the solution to many unsolved problems about plants. When these facts are determined we know what plants to grow, how to grow them, how to protect them from disease, and how to improve them. There are many different kinds of research being carried on at the Garden. For the present it is enough to say that one of its most important functions is the investigation of fundamental questions involving plant life. Sometimes the results obtained have had a far-reaching effect on horticulture and botany.

Instruction: Formal instruction in botany is given to graduate students who register in the Henry Shaw School of Botany of Washington University. These students come from colleges and universities all over the United States and are candidates for higher degrees.

Mr. Shaw also desired that the Garden give instruction in gardening, and this is at present provided for through a system of apprenticeships and courses offered to amateurs. The apprentices spend half their time in practical work, rotating through the various departments of the Garden. The rest of the time is devoted to regular courses given in the Henry Shaw School of Botany. Under instruction might also be included the vast amount of botanical and horticultural information given to inquirers, not only locally but throughout the whole country. The Missouri Botanical Garden has come to be recognized as one of the chief sources of information on what a plant is, how to grow or protect or propagate various plants and trees. Thousands of such questions are answered every year either by telephone or letter.

Collections: The foresight of Mr. Shaw in providing a most substantial start towards collections of books and dried plants cannot be too highly commended. He was well enough informed to know that a good library is a very vital part of a scientific institution, and with the help of Dr. George Engelmann, he amassed a considerable number of botanical works. This formed the nucleus of the present Missouri Botanical Garden library, which is now one of the most important collections of botanical books in the world.

The advice of Dr. Engelmann was also very helpful to Mr. Shaw in starting an herbarium. This is not, as might be supposed, a collection of herbs, but of dried plants for study and reference. Since no botanist can travel over the entire world to secure specimens of plants, it is necessary to have large collections from all parts of the globe assembled in one place where they can be compared and studied. The plants are carefully dried and mounted on stiff paper, assembled in folders, and kept in steel cases, as near dust- and insect-proof as possible. The Herbarium of the Missouri Botanical Garden contains over a million of these dried specimens, and it is one of the most important in the country.

Collections of growing plants: Visitors in general are better acquainted with these than with the books or herbarium specimens. Such collections as those to be found in the iris garden, the rose garden, the medicinal garden, the economic garden, etc., are visited by thousands of gardeners from all over the country, not only because of the beauty displayed but to study the different varieties and determine what kinds they want for their own gardens. As soon as the Arboretum can be opened to the public, additional collections of living plants will be available, particularly of trees and shrubs.

Exhibitions: This phase of the Garden's work is best known to the public. In fact, many people suppose it is the only activity carried on by the Garden. In the years soon after Mr. Shaw's death, an exhibition of chrysanthemums was staged in a tent every fall. Gradually, as facilities increased, the chrysanthemum show grew to be one of the chief attractions at the Garden. But it is not the only show by any means. In fact, from the first of November until the first of July there is a continuous display of flowers in the Floral Display House. Following the chrysanthemum show comes the Christmas show of poinsettias and then in February one of the outstanding shows of the country, namely, the orchid show. From then on, there is a continuous succession of blooming plants under glass until the summer months, when the outdoor collections of iris, roses, water-lilies, etc., provide the floral display.

G. T. M.

ST. LOUIS SCHOOLS AND THE GARDEN

Since 1936, through the cooperation of the St. Louis Board of Education, Miss Clara M. Heising has been stationed at the Garden as a guide and special nature study teacher for children from the public schools. From her office at the Main Gate there goes out every month to the school-teachers of St. Louis, suggestions as to points worth noting on a trip to the Garden. It is interesting to leaf through one of these outlines and note the variety of educational opportunities afforded here. There are, of course, the various plants, grown indoors and out, with particular reference to those which are in flower or fruit. Of special interest are the economic plants—farm crops, fibre plants such as cotton and flax, peanuts and pumpkins, the vanilla vine and the chewing gum tree. Yet plants make up only about a third of the items on Miss Heising's list. There are birds and bird-nests, and curious and important insects. There are horticultural operations to study, pruning of trees and shrubs, pruning the palms in the Palm House, the use of the big power mowers and of the automatic sprinklers during dry weather. The design of the Garden is suggested as being worthy of note, and a visit to Mr. Shaw's mausoleum is most appropriately a reminder of the way in which a single civic-minded individual can contribute to the richness of life in his community.

NOTES

The October number of the *Flower Grower* (**28:** 455–456) contains illustrations on "Bulbs," from the Garden BULLETIN.

Mr. George H. Pring, Superintendent of the Garden, spoke before the Ladies' Aid Society of St. Peter's Evangelical Church, October 2, on "Romance of Flowers."

"Growing Plants from Seed," an article by Mr. Paul A. Kohl in the April Garden BULLETIN, has been reprinted in condensed form in the September number of *Home Gardening* (**1**: 160).

Recent visitors to the Garden include: Mr. and Mrs. Howard Scott Gentry, collectors of tropical plants; Mr. Benjamin Lowenhaupt, graduate student, University of Chicago; Dr. Donald F. Jones, Plant Geneticist, Connecticut Agricultural Experiment Station, New Haven; Dr. E. G. Anderson, Geneticist, California Institute of Technology, Pasadena; Miss Ruth D. Sanderson, Librarian, Gray Herbarium of Harvard University, Cambridge, Mass.

ANNOUNCEMENT

A. D. E. Elmer's "Leaflets of Philippine Botany"

for sale by the Missouri Botanical Garden

> "Are the 'Leaflets of Philippine Botany' in your library? Every botanical institution should have them, and at the present time I can offer for sale complete series of the ten published volumes including a general index for the entire works. Remember, this publication will no longer be published. Its average price is $11.00 for each volume."
>
> A. D. E. ELMER.

All of the available sets of Elmer's "Leaflets of Philippine Botany" have been deposited at the Missouri Botanical Garden. A few complete sets are available, and practically any of the single leaflets may be obtained at 5c a page.

Orders may be sent direct to the

Missouri Botanical Garden
2315 Tower Grove Avenue
St. Louis, Missouri

STATISTICAL INFORMATION FOR SEPTEMBER, 1941

GARDEN ATTENDANCE:	
Total number of visitors	32,426
PLANT ACCESIONS:	
Total number of plants and seed packets received as gifts	170

LIBRARY ACCESSIONS:

Total number of books bought	5
Total number of books and pamphlets donated	137

HERBARIUM ACCESSIONS:

By Purchase—	
Hinton, George B.—Plants of Mexico	1,000
By Gift—	
Anderson, Edgar—Plants of Missouri and New York	9
Bovard, Mrs. Oliver K.—*Boronia megastigma* Nees, from Australia	1
Brenner, L. G., Jr.—Plants of Mississippi	107
Chandler, A.—*Dryopteris fragrans* (L.) Schott. var. *remotiuscula*, from Minnesota	9
Darker, G. D.—Plants of Ontario, Canada	13
Dugand, Sr. Armando—*Tabernaemontana amygdalaefolia* Jacq. from Colombia	1
Garrett, A. O.—*Crataegus succulenta* Rydb. from Utah	1
Gay, Mrs. L. P.—*Kochia scoparia* (L.) Roth. from Missouri	1
Gentry, Howard Scott—Orchid from Mexico	1
Greenman, J. M.—Photographs of type specimen of *Senecio Riddellii* Torr. & Gray	2
Greenman, J. M.—Plants of Missouri	32
Holtzen, E. E.—Plants of Missouri	4
Hubricht, Leslie—Plants of Missouri	4
Langley, Mrs. Charles—*Cassia* sp. from Missouri	3
Massachusetts State College, Amherst, Massachusetts, by Robert B. Clark—Plants of New England and of Horticulture	239
McGugin, William—*Monotropa uniflora* L. from Washington	1
Nicoll, Mrs. William Todd—Plants of Kentucky	2
Schery, Robert W.—Plants of Mexico	359
Seibert, Russell J.—Photograph of E. L. Ekman, plant collector	1
U. S. National Museum—Lichens of Arizona	4
By Exchange—	
Barkley, Fred A.—Plants of Montana	340
Cooke, William B.—Plants of California	202
Gray Herbarium, Harvard University—Plants of western United States	164
Montana State University—Plants of Montana	60
By Field Work—	
Allen, Paul H.—Plants of Panama	93
TOTAL	2,653

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OF THE MISSOURI BOTANICAL GARDEN

THE GARDEN, 2315 TOWER GROVE AVENUE, ST. LOUIS, MISSOURI

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Director

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American Midland Naturalist

"Should be of great use to local garden clubs, and for the scientific worker who is concerned with the local flora it should be invaluable."

National Horticultural Magazine

"Carefully and critically done, so that it should find wide and enthusiastic reception at the hands of all who enjoy being acquainted with the rich native flora of Missouri."

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Field Museum Notes

For sale by the Missouri Botanical Garden. Price $3.00

MISSOURI BOTANICAL GARDEN BULLETIN

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1889

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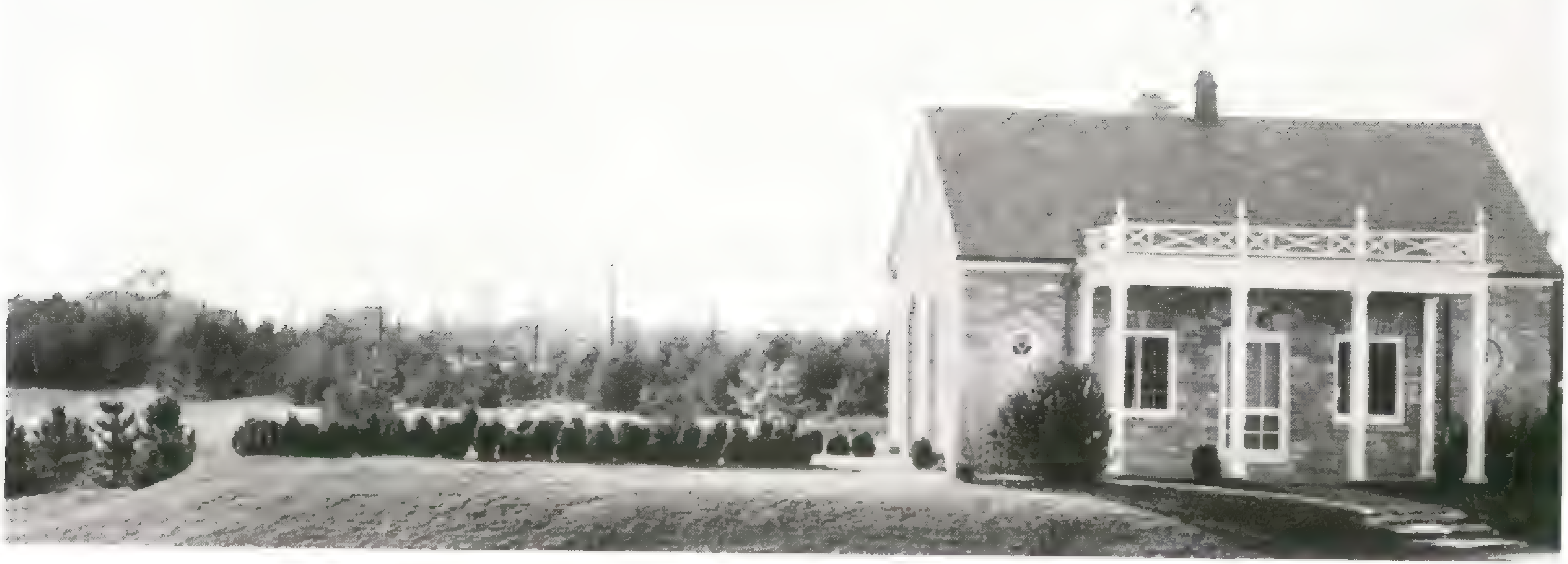
SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date to the death of Mr. Shaw, in 1889, the Garden was maintained under the personal direction of its founder, and while virtually a private garden it was, except at certain stated times, always open to the public. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was designated by Mr. Shaw as its official title and in his will and all of his writings he specifically referred to it as the "Missouri Botanical Garden." By a provision of Mr. Shaw's will the Garden passed at his death into the hands of a Board of Trustees. The original members of the Board were designated in the will, and the Board so constituted, exclusive of certain ex-officio members, is self-perpetuating. By a further provison of the will, the immediate direction of the Garden is vested in a Director, appointed by the Board of Trustees. The Garden receives no income from city or state, but is supported entirely from funds left by the founder.

The city Garden comprises 75 acres, where about 12,000 species of plants are growing. There is now in process of development a tract of land of over 1,600 acres outside the city limits which is to be devoted to (1) the propagation and growing of plants, trees, and shrubs, designed for showing either indoors or outside, at the city Garden, thus avoiding the existing difficulties of growing plants in the city atmosphere; (2) gradually establishing an arboretum as well as holding a certain area as a wild-flower reservation, with the idea that possibly at some future time this may become the new botanical garden.

The Garden is open to the public every day in the year except New Year's Day and Christmas—week days from 8:00 a. m. until sunset; Sundays from 10:00 a. m. until sunset. The greenhouses are closed every day at 5:00 p. m.

The main entrance to the Garden is located at Tower Grove Avenue and Flora Place, on the Sarah car line (No. 42). Transfer south from all intersecting lines. The Garden may also be reached by the Tower Grove bus (No. 21).



LODGE AT ENTRANCE TO ARBORETUM

Missouri Botanical Garden Bulletin

Vol. XXIX NOVEMBER, 1941 No. 9

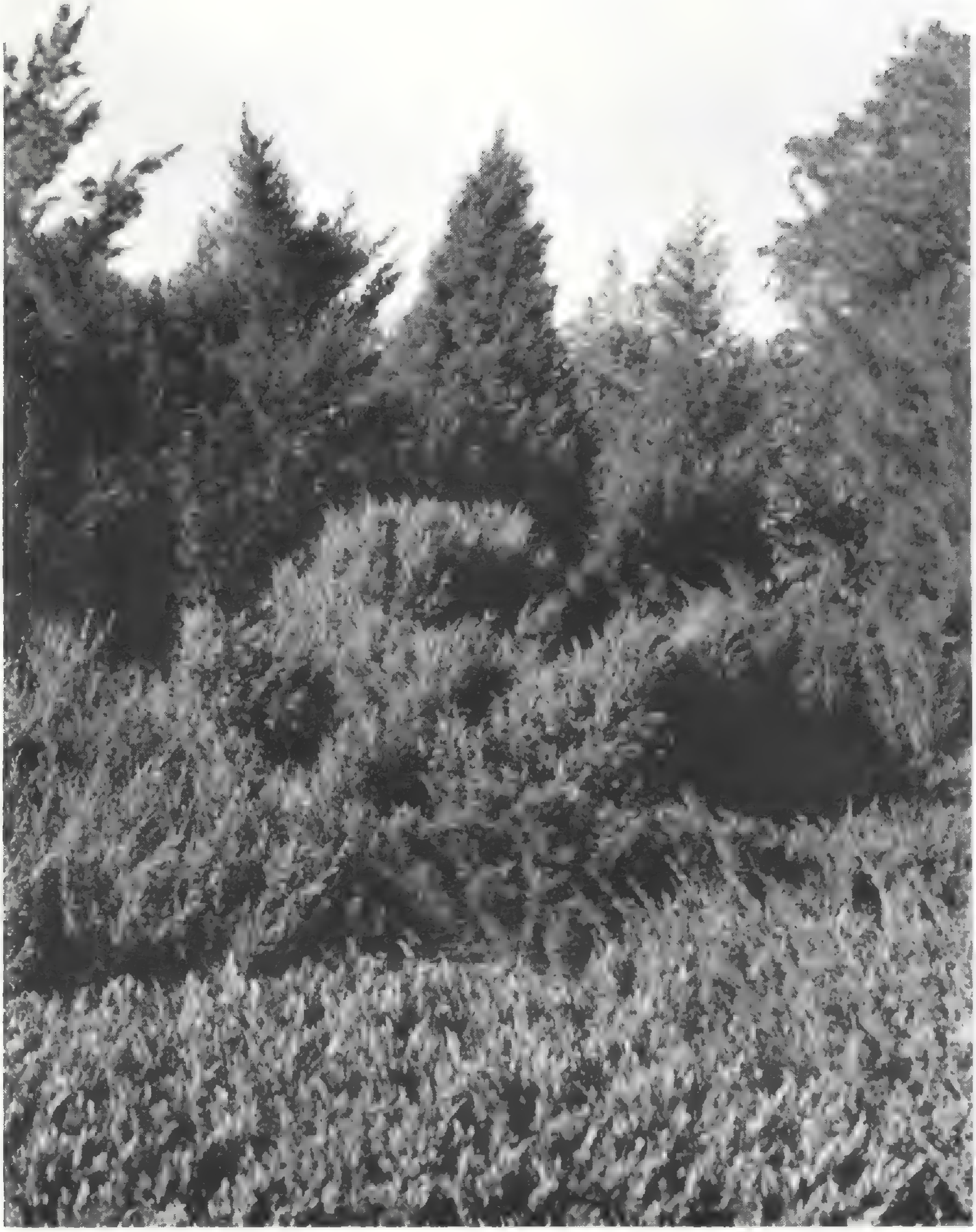
EVERGREENS FOR ST. LOUIS

The enforcement of the smoke ordinance makes evergreens a timely horticultural subject in St. Louis. Last winter, for the first time in many years, the air was so clean that had there been large evergreen trees here their damage from smoke would have been negligible. If, year in and year out, the city air can be kept as clear as it was last winter, coniferous evergreens may again become one of the main features in St. Louis gardens. While we are too close to the dry air and violent temperatures of the great plains to grow the monumental century-old spruces and firs which grace northern gardens, there is no inherent reason why we should not have very creditable collections of evergreens in this part of the country. Henry Shaw had ninety-nine species in his pinetum, and it was generally recognized as the most outstanding collection in the Middle West.

It is unfortunate in more ways than one that this collection of Henry Shaw's should have perished from the smoke. Had it persisted we should now be able to make definite recommendations to gardeners of the St. Louis area. As it is, our recommendations about what to plant must be more or less tentative. Even more than with other kinds of trees, it is difficult to bring coniferous evergreens to full maturity in environments which differ greatly from those to which they are native. A pine or spruce may grow well for five or ten or even twenty-five years after it is transplanted and then die suddenly if it does not like the new climate. The Norway Spruce, for instance, in northern Europe reaches an immense age and becomes a great towering spire which dominates and glorifies the gardens in which it is grown. In eastern North America this same species grows for only thirty or forty years, lustily at first and then slower and slower, most old specimens either dying or becoming very unsightly. Only in exceptional situations with us does the Norway Spruce do anything like as well as a mature tree as it does in northern Europe. Every region therefore needs a big arboretum as a proving ground for evergreens. From such an arboretum can come authoritative recommendations as to which evergreens to plant for immediate effect and which can be relied upon to increase in beauty and dignity with each decade.

The Missouri Botanical Garden, realizing the need for just such information, did start a pinetum as soon as it established its new arboretum outside of the smoke zone. That was only fifteen years ago, and while the oldest plantings are already beginning to put on an air of maturity it is still much too soon to make definite recommendations for this region. The following bulletin, therefore, has been made up of material from a number of sources: the experiences of local amateurs with gardens well outside the former smoke zone; our preliminary results at Gray Summit; and what has been learned at arboreta in other parts of the country.

Before we can begin any general discussion of evergreen trees, we must be fairly precise about exactly what we mean by that term. For the purpose of this bulletin we shall use it as loosely as the general public. When they say evergreens, they do not mean all trees which are "ever green" and often include under that term such trees as the larches and bald cypresses which shed their leaves during the winter. What we really should say is "conifer," a precise botanical word which means cone-bearing and which is the proper designation for all the Christmas trees and their relatives, for the spruces, pines, junipers, cedars, and such like kinds of plants, plants which are more or less resinous, which are ordinarily evergreen, and whose seeds are not borne within a seed-pod but are customarily carried upon the scales of a cone. They are always woody, though a few kinds are procumbent and only a few inches high. None of them have showy flowers, though the female cones of a few species are brightly colored in the spring.



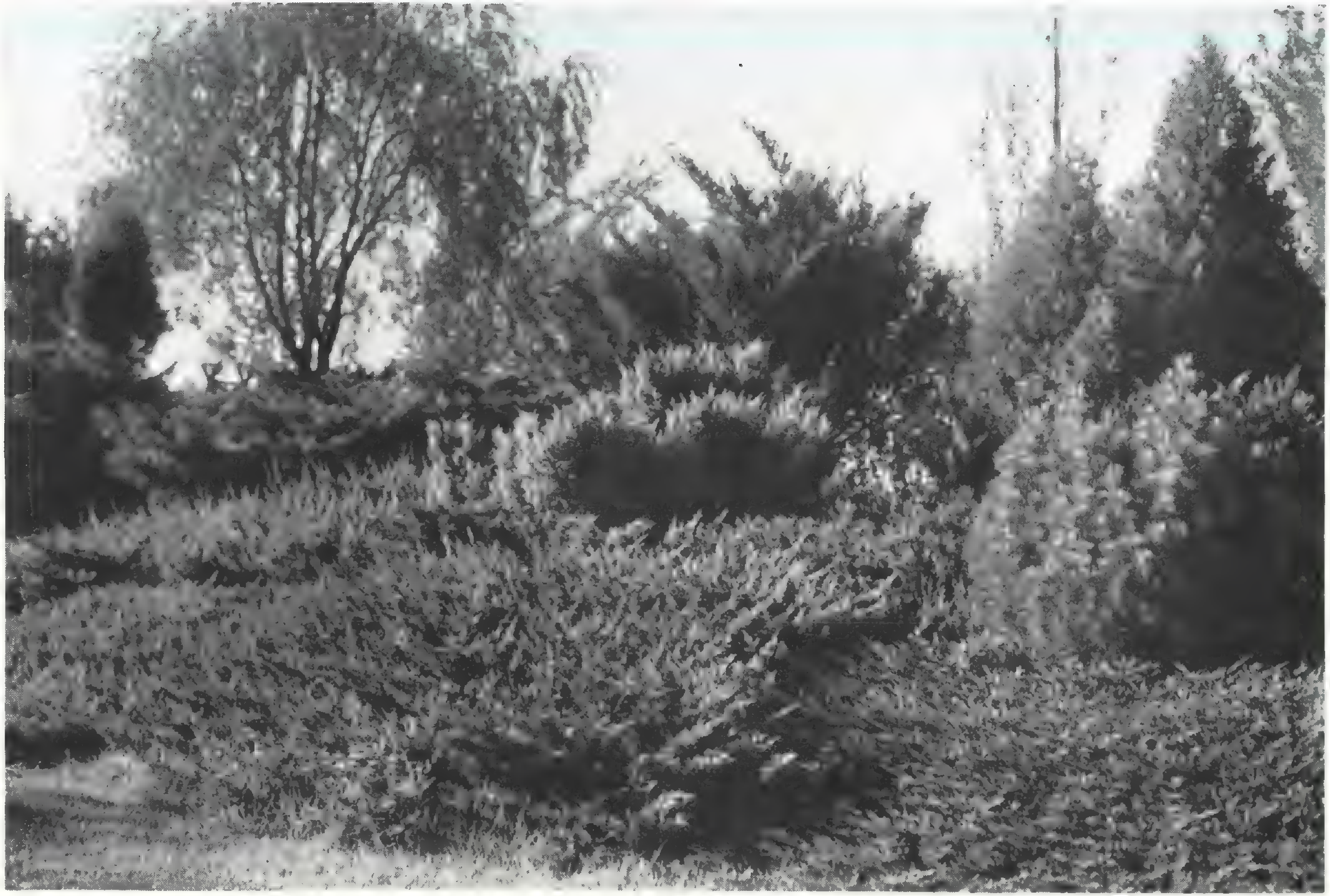
Collection of junipers, showing wide variety of texture, color, size and form: foreground, the low-growing Waukegan and Japanese junipers; center, Prostrate Common Juniper; background, Red Cedars.

All of them have leaves which are more or less needle-like, varying from short, flat, overlapping scales to the long, slender needles of the pine trees.

Technically, conifers are seed plants, not flowering plants, but this should not encourage the ordinary home owner to try and grow them from seed. They require such special conditions of light and moisture that it is best to leave their early care to those nurserymen who make a specialty of it. The average homeowner should not attempt to deal with them until they have been transplanted two or three times and have a well-developed root system. He will do well to limit himself at first to plants which have been dug with a ball of earth around them and this immediately protected with a covering of burlap (the phrase balled and burlapped, "B & B," is universally used in the nursery business to indicate such specimens.)

For the beginner the most important advice is to avoid bargains. Cheap evergreens, carelessly grown and carelessly dug, may occasionally succeed, but the beginner cannot usually rely on such good fortune. Evergreens are particularly susceptible to stunting in the nursery unless given expert care, and such stunted specimens seldom grow into flourishing trees. In the long run, cheap, carelessly grown and poorly packaged evergreens are more expensive than good specimens which have been well grown, conscientiously transplanted, and carefully balled and burlapped. It is better to pay a few extra dollars and get such a specimen than to waste time and effort in growing a bargain plant which is unsightly and short-lived.

For the St. Louis area fall is the most practical time for transplanting. While it can be done in the spring, in February or early March, the season then is likely to be short, and by the time the frost is out of the ground there are many other things which claim attention. Fall transplanting can be carried on any time from mid-September until the ground freezes. A generous hole should be dug, at least twice the diameter of the ball of earth on the tree to be planted. If there is any slope to the site, the soil should be thrown out on the down-hill side. If this is done, after the transplanting is completed there will be a little rim of dirt forming a saucer which automatically holds moisture when the tree is watered.



A charming collection of coniferous evergreens growing in the garden of Dr. George H. Bishop, well outside the former smoke zone of St. Louis. This photograph shows what a wide range of form and texture such evergreens afford.

A gardener of any experience will know that evergreens should be watered after they have been transplanted, but very few realize how thoroughly they should be soaked down and how long they should be looked after to keep the soil from drying out. As a minimum, they should be given very careful attention for all the first winter and all the following summer. Most people realize that evergreens, coming mostly from the North, need special attention in hot, dry weather, but they usually forget that, just because they are evergreens, they need moisture in the dry winter air as well as in the summer. In the St. Louis area our late and early winters are often excessively dry, and newly transplanted evergreens need to be carefully watched at such times.

The problem of maintaining proper soil moisture can be greatly simplified by the use of a good mulch. In the North, winter mulches are sometimes applied to prevent rapid changes in soil temperature during the winter. Here they serve a double purpose since they can also be very effective in keeping the soil from drying out too rapidly. Such a mulch should be over four inches deep and wider than the hole which was dug when the tree was planted. An ideal mulch would be extremely well-rotted stable manure which contained a good deal of bedding straw. Spent hops are nearly as good, and oak sawdust or bushy hay or a combination of hay and leaves may be used.

It is much easier to care for evergreens which have been planted in a proper site than to struggle with them in a bad location. If possible, situations exposed to strong winter winds should be avoided. Winter, strangely enough, is one of the most difficult times for most evergreens. Their leaves are alive and using moisture, yet the air is dry and the water in the soil is frozen and unavailable. Strong winds at such a time create almost desert conditions for large evergreens. A spot sheltered from these winter winds, with well-drained soil (the sandier the better), and away from the domination of broad-leaved trees is advisable. Most evergreens will not welcome the shade of other trees and all of them resent competition with roots of such trees, particularly of elm and poplar.

While many people automatically apply fertilizer to all newly transplanted trees, it can well be withheld from evergreens until a year after they have been set out. By this time their roots will be established and they will be ready to profit from it. Organic fertilizers are preferable if they can be obtained; otherwise a strong commercial fertilizer will serve. A formula somewhere in the neighborhood of 10-8-6* is advisable, and it should be applied at the rate of half a pound for every foot in height of the tree. It should of course be scattered over an area as wide as that of the branches of the tree or even a little wider.

Once an evergreen is well established it does not require a great deal of special care. In the North and East, cultivation of the ground is often recommended, but with us mulches are better than hoeing. If possible a good mulch should be applied every fall. Evergreens will need watering only in times of drought. Even then they should not be sprinkled but should be given a long, thorough soaking. The ordinary gardener with a small lot will find it practicable to use the hose, turning the water so low that it is just barely running and letting it soak into the ground at the base of the tree for at least twenty-four hours. Even in dry summers such a soaking is not needed oftener than once a month. One can tell how soon it is required by examining the soil under the mulch; when it begins to get dry and powdery another watering is needed.

If any of the lower branches die, they should be taken out immediately, making the cut close to the trunk so that it will heal over smoothly. No further pruning is recommended except in very exceptional cases. Sheared evergreens can be very beautiful if properly used and properly cared for, but it is best for the nonprofessional gardener not to attempt them in St. Louis. Most evergreens do not have a very wide margin of safety in this region and when the young leaves and branches are clipped back an unnecessary burden is put upon the tree.

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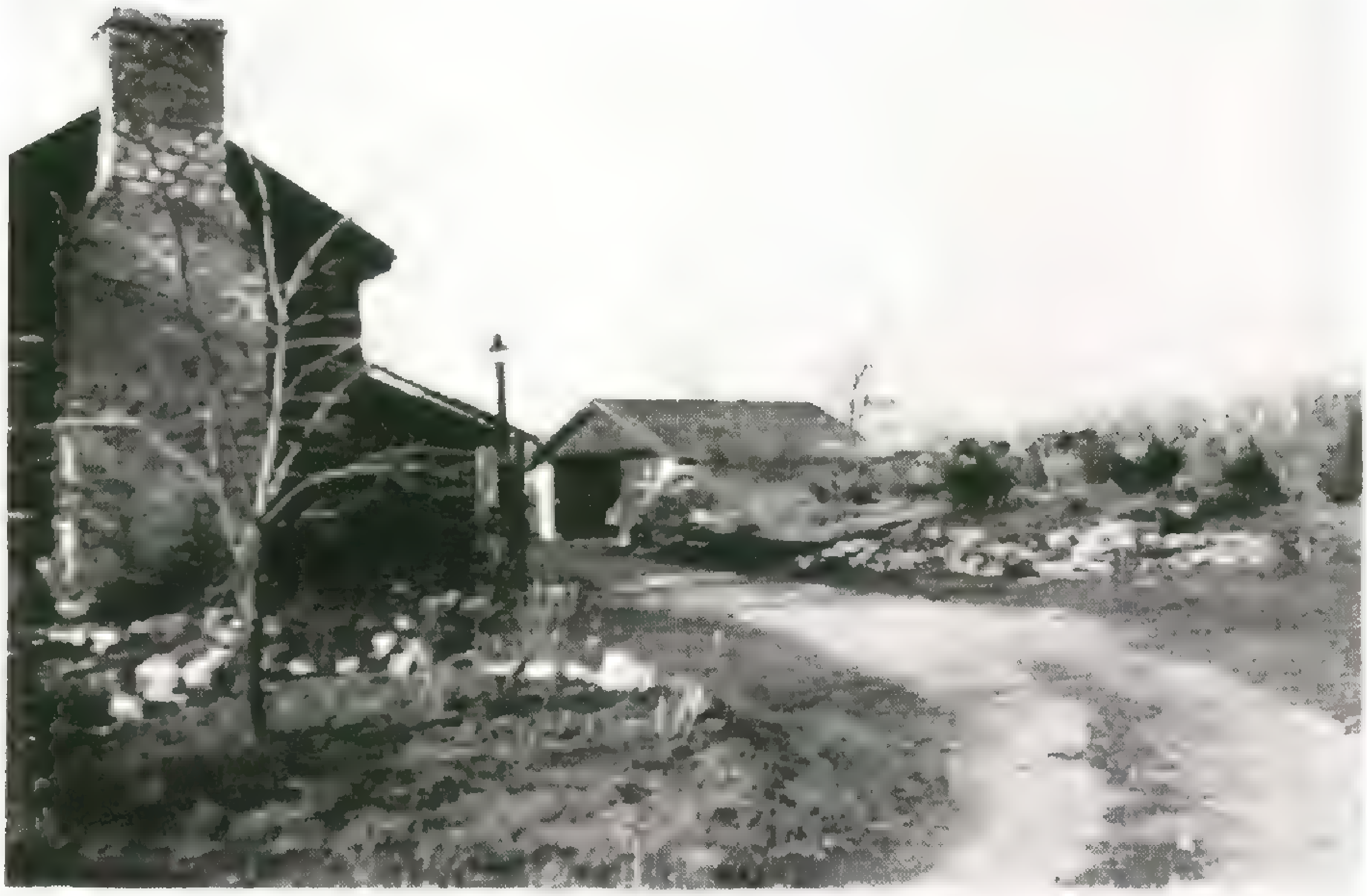
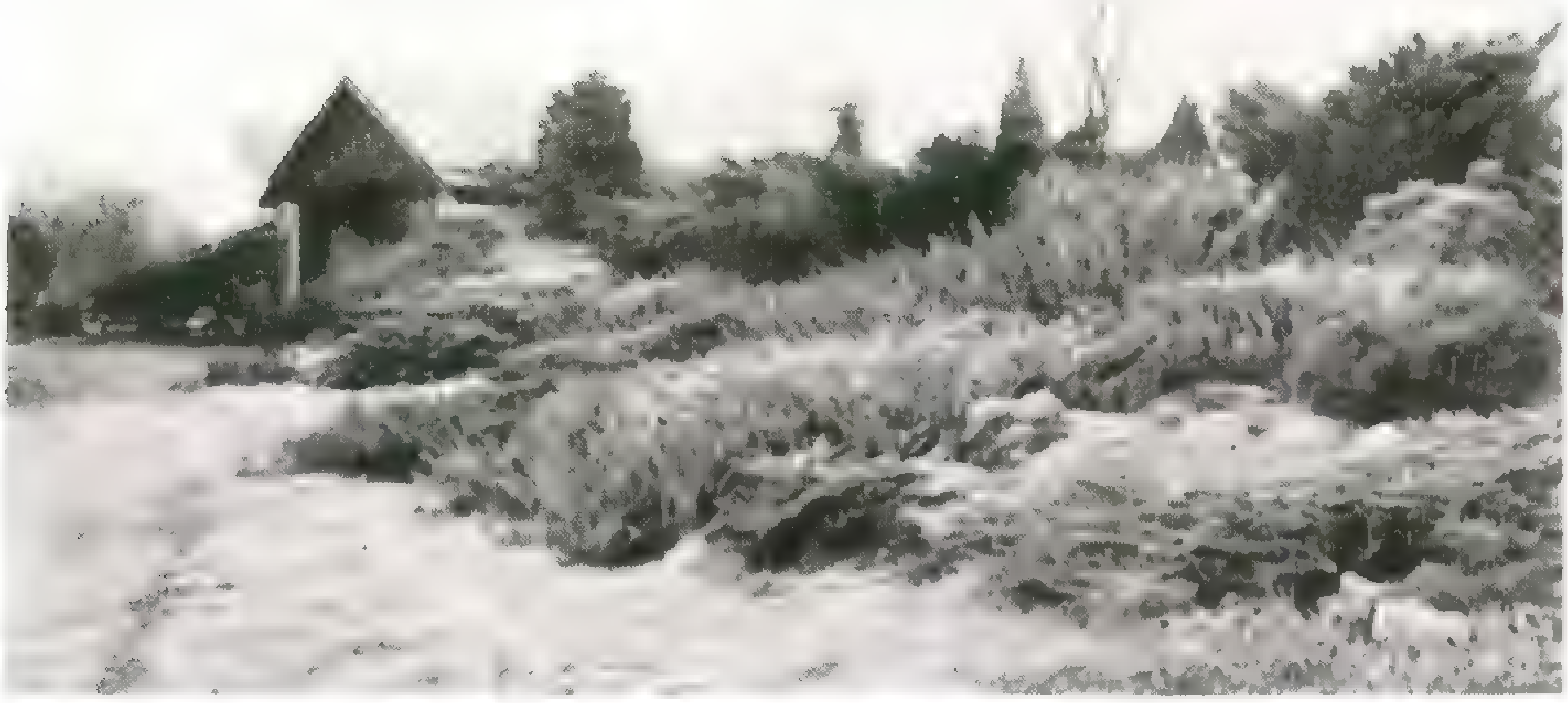
* To make 100 lbs. of a 10-8-6 formula:

Ammonium sulphate or Nitrate of soda	50 lbs.
Superphosphate	38 lbs.
Muriate of potash	12 lbs.
	100 lbs.





The garden of Dr. George H. Bishop, showing how evergreens judiciously planted can transform a landscape: top, 3 years after planting; bottom, same location 7 years after planting; opposite, 10 years after planting.

PESTS AND DISEASES

Fortunately for the prospective grower of conifers in the Midwest, there are relatively few pests and diseases that attack these plants. Among the most ravenous of the insects are the bagworms which attack arborvitae, junipers, and sometimes spruces. If the infestation is slight the individual bags may be cut off and burned before the middle of May when the larvae are hatching; otherwise it will be necessary to spray the plants soon after the larvae have been hatched.*

During the hot, dry weather of summer, red spider infestation becomes a menace. This insect is particularly noticeable on the short-needled trees, such as spruces and some junipers, causing the foliage to turn rust-colored. Use a pyrethrum spray according to manufacturer's directions as soon as the condition is recognized.

The cedar-apple, indicated by the presence of "apples" on the twigs of junipers, is a fungus which must spend part of its lifetime on apple trees. Hence, control lies either in the eradication of apple trees in the immediate vicinity of junipers or in giving up the culture of this type of evergreen. If the number of "cedar-apples" is small, each one may be picked off and burned. When infestation is bad, use a colloidal sulphur spray at two-week intervals in early spring.

The symptoms of the juniper blight are browning of the foliage and a cankerous growth just beneath the bark. Control is very difficult, and the most expedient method is to cut off and burn all diseased branches. Certain junipers are more susceptible than others; *Juniperus Sabina, J. virginiana* (especially the Platte River strain) and var. *tripartita* are less resistant than is *J. chinensis,* whereas *J. excelsa* seems practically immune.

In large plantations in the country, such as the pinetum at Gray Summit, one of our native woodpeckers, the sapsucker, can do a great deal of damage in the spring. These birds drill rows of small holes until the sap is flowing freely and then make the rounds from tree to tree, sucking the sap and drilling a few new holes at each trip. While they are ordinarily more entertaining than dangerous they can occasionally become a very real nuisance,

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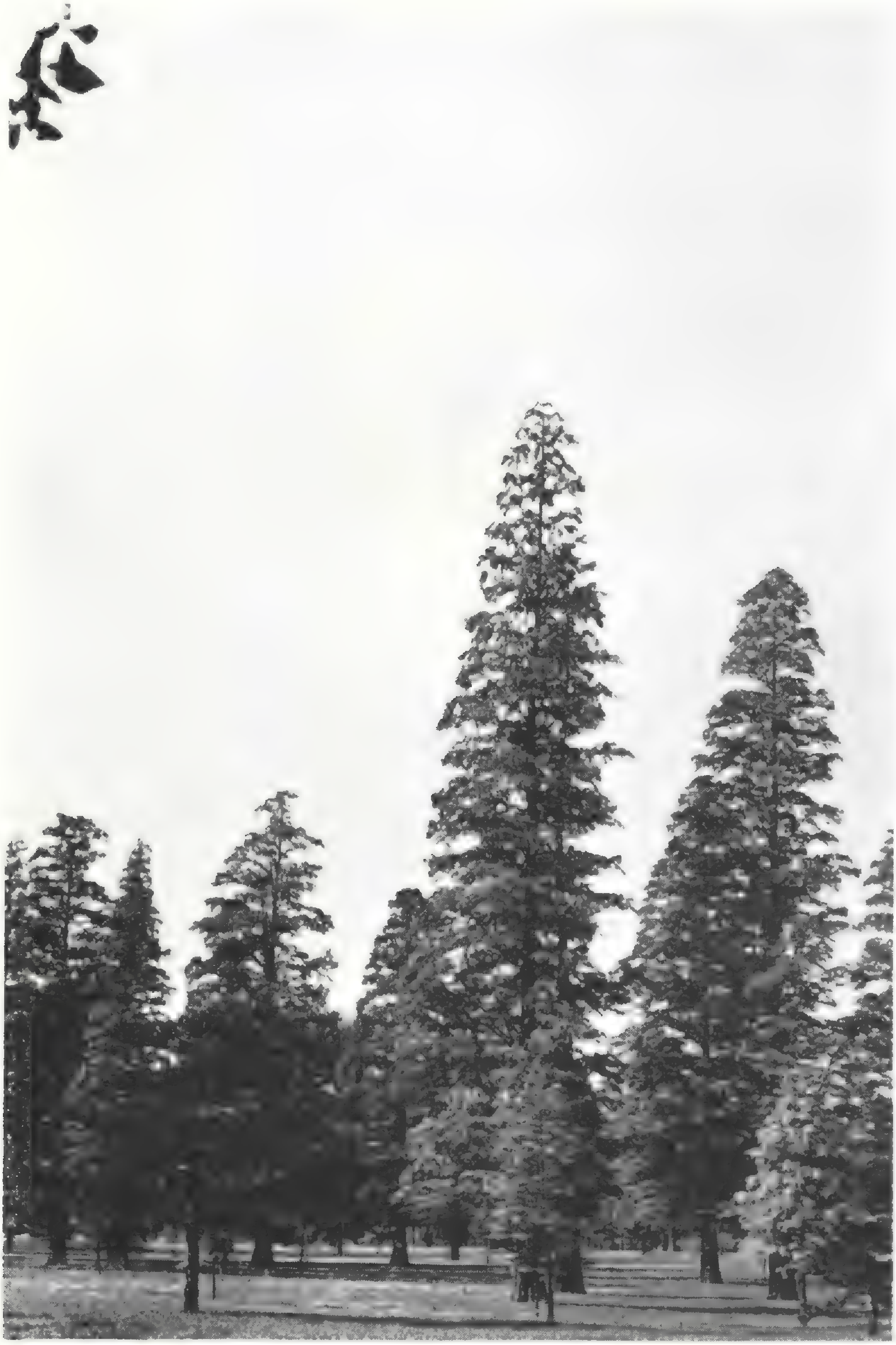
* Use 4 lbs. arsenate of lead to 100 gals. of water, plus 1 lb. of a spreader and sticker such as "Kayso."



Group of Bald Cypress trees in Tower Grove Park, St. Louis. Tallest specimen in photograph is approximately 75 feet high.

and at Gray Summit they girdled the main trunk of one Scots Pine, killing the upper part of the tree. Several other trees of this species have been quite seriously damaged by the same group of birds.

BALD CYPRESS

Of those conifers which can be grown in St. Louis the Bald Cypress *(Taxodium distichum)* is particularly to be recommended. It has done universally well in the city, the Garden and Tower Grove Park containing magnificent specimens planted in Mr. Shaw's time. It is not really difficult to establish, and it should be much more widely planted. Until recently it was difficult to purchase young plants but they are now available at a number of nurseries.

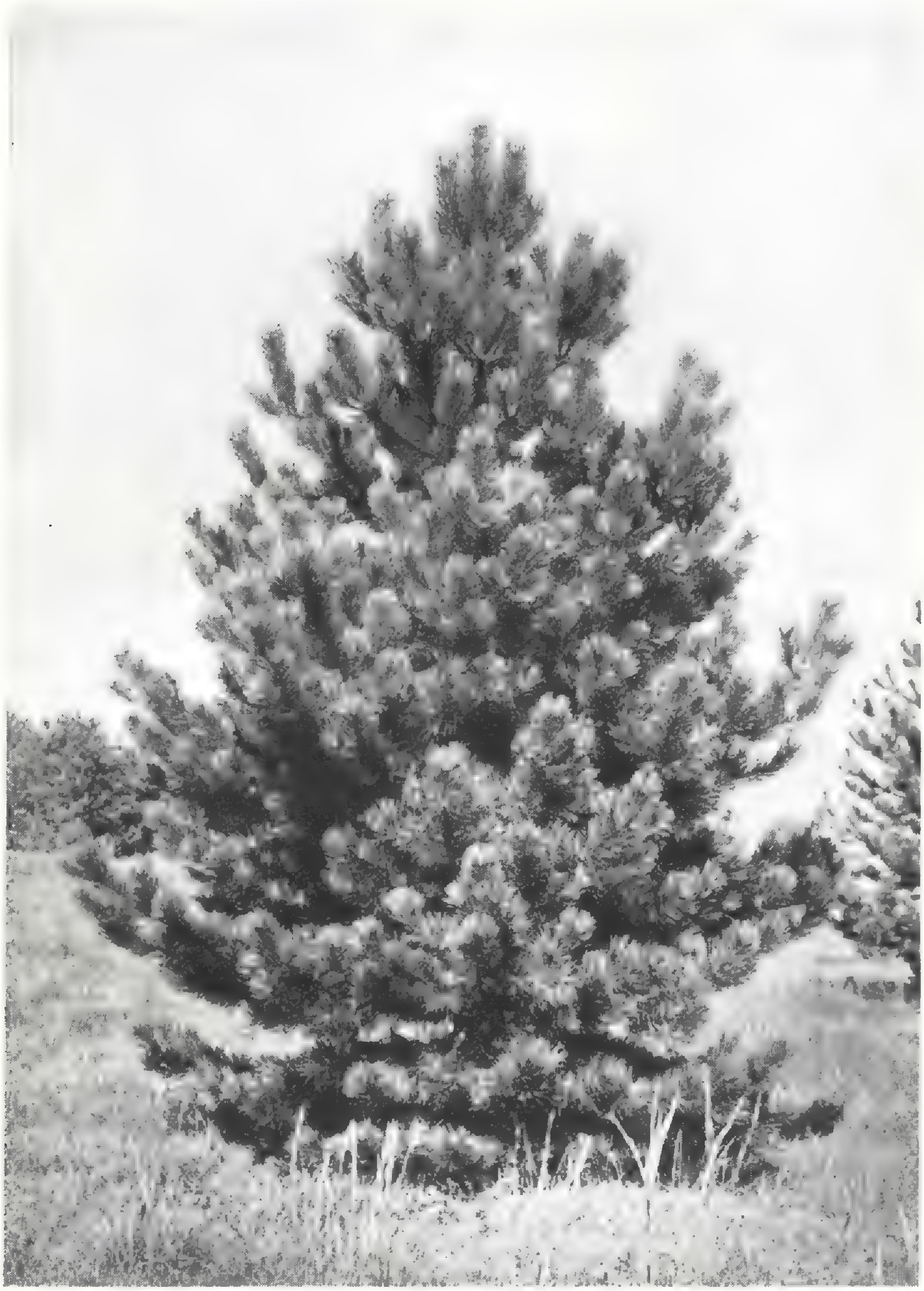
The Bald Cypress is one of those exceptional conifers which loses its leaves in the autumn but its striking pyramidal form makes it beautiful even in the winter landscape. In the spring, when the needles first appear they are a brilliant light green, and in the fall they fade most attractively from green to yellow and from yellow to brown.

Realizing the importance of the Bald Cypress for the gardens of this region, the Garden began, several years ago, an experiment with seedlings from various parts of the natural range of the species. While they are still young they demonstrate that there are very great differences in the geographical races, even when they are grown in the same garden. Particularly striking are the trees from west Texas, which are lower, with more contorted trunk, and bark so resinous that they are not injured by bark-nibbling rabbits.

PINES

The pines, as a group, are distinguished by their long slender needles borne in groups of two, three, or five. Aside from one or two dwarf varieties, they are all tree-like and most of them grow into large specimens which may live for hundreds of years when well cared for.

Austrian Pine *(Pinus nigra)*.—This is a variety of the European Black Pine, and is particularly to be recommended. It grows very rapidly for about twenty years and then much more



Fifteen-year-old specimen of Austrian Pine at the Missouri Botanical Garden Arboretum, Gray Summit, which has attained a height of 12 feet and a spread of 7 feet.

slowly. It makes a dense screen when young, and has proved more resistant to the city smoke than any of the other evergreens in Mr. Shaw's original pinetum.

SCOTS PINE *(Pinus sylvestris)*.—While this is very commonly offered by nurserymen because of its rapid growth as a young tree, it cannot be highly recommended for the St. Louis region. Though frequently planted in gardens near the city there are few old specimens still persisting, and those few which we have seen are in rather sheltered positions (as, for instance, in the old Dawson Arboretum at the Epworth Home in Webster Groves). The species is widespread in Europe and includes various geographical races and horticultural forms. It is highly probable that if seed of a central European race could be obtained this species would stand up better under our mid-continental conditions than do most of the Scots Pines now in the trade.

The Scots Pine is characterized by a more or less crooked trunk in old specimens and a bark which is of a warm cinnamon-brown in the upper part of the tree. The foliage is apt to be rather thin with us, and at the Arboretum this species is the one most extensively injured by sapsuckers.

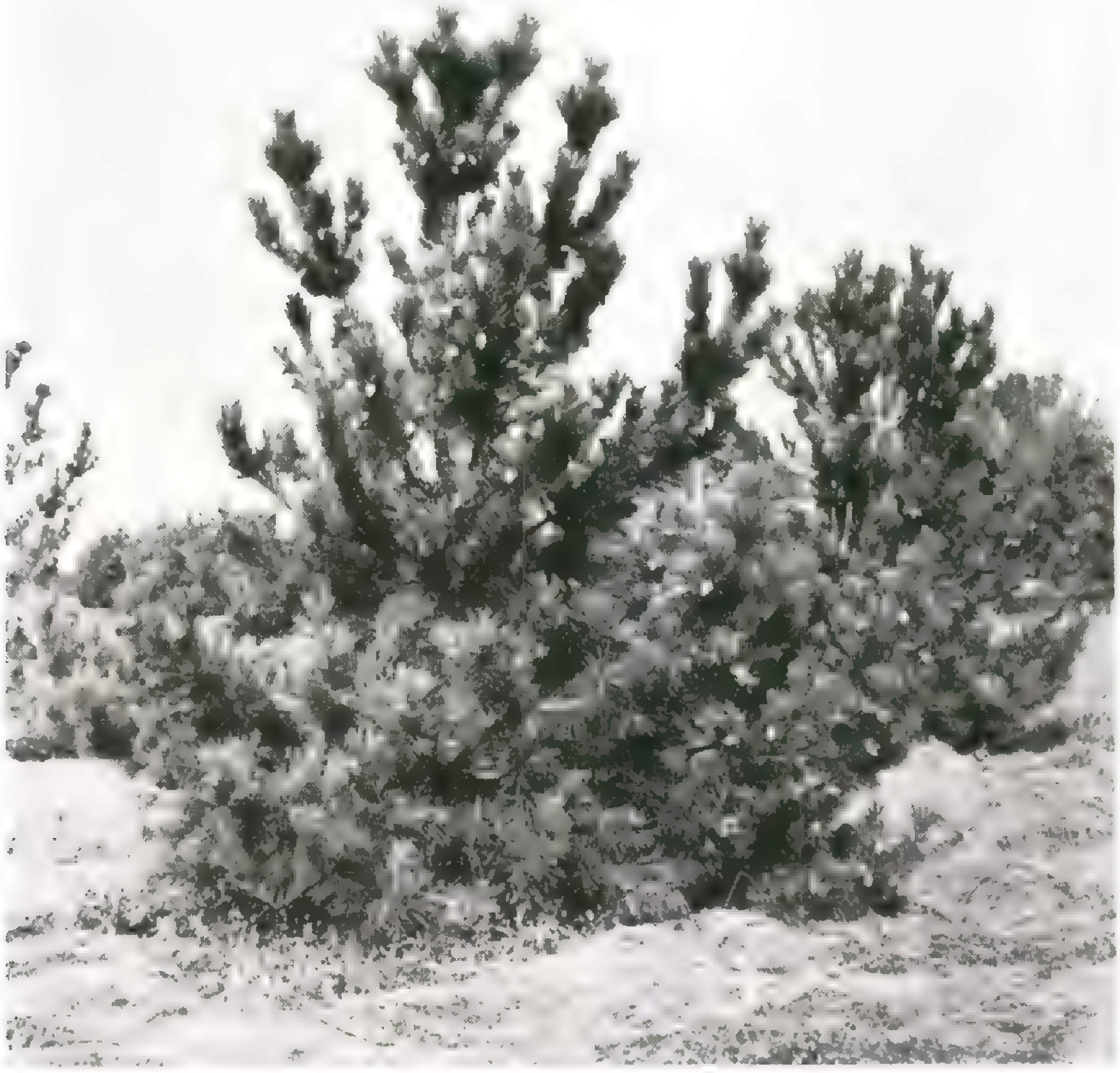
WHITE PINE *(Pinus Strobus)*.—This species, native to eastern North America, is one of the "five-needle pines," its soft bluish-green needles being arranged in bundles of five. While it eventually forms a tall and magnificent tree, it is likely to be somewhat straggly when young. In the neighborhood of St. Louis there are a number of large specimens which are doing well and which have come through the drought years in good condition. It should be planted much more frequently than it is, even though it may not make a bushy little Christmas tree in its early years. Once it is well established it grows extremely rapidly and makes an increasingly fine appearance every year.

BULL PINE *(Pinus ponderosa)*.—This is one of the big, long-needled pines from the West, and, like many western American plants, is made up of various geographical races and sub-species. These different types will undoubtedly behave somewhat differently in St. Louis but too few of them have been tried to permit definite recommendations. The tree is rather sloppy though picturesque. Some of those planted at the Arboretum have been winter-killed but others are doing well. There is a magnificent old specimen at Alton, Illinois.

Jack Pine *(Pinus Banksiana)*.—The Jack Pine is the scrub pine of the North. It has short needles, a picturesque shape and open, rather than dense foliage. It is too scrubby for general use but makes a beautiful appearance if planted in a suitable spot. So far as we know, there are no old specimens in the St. Louis region but the oldest ones at the Arboretum have nearly reached maturity and are still doing well.

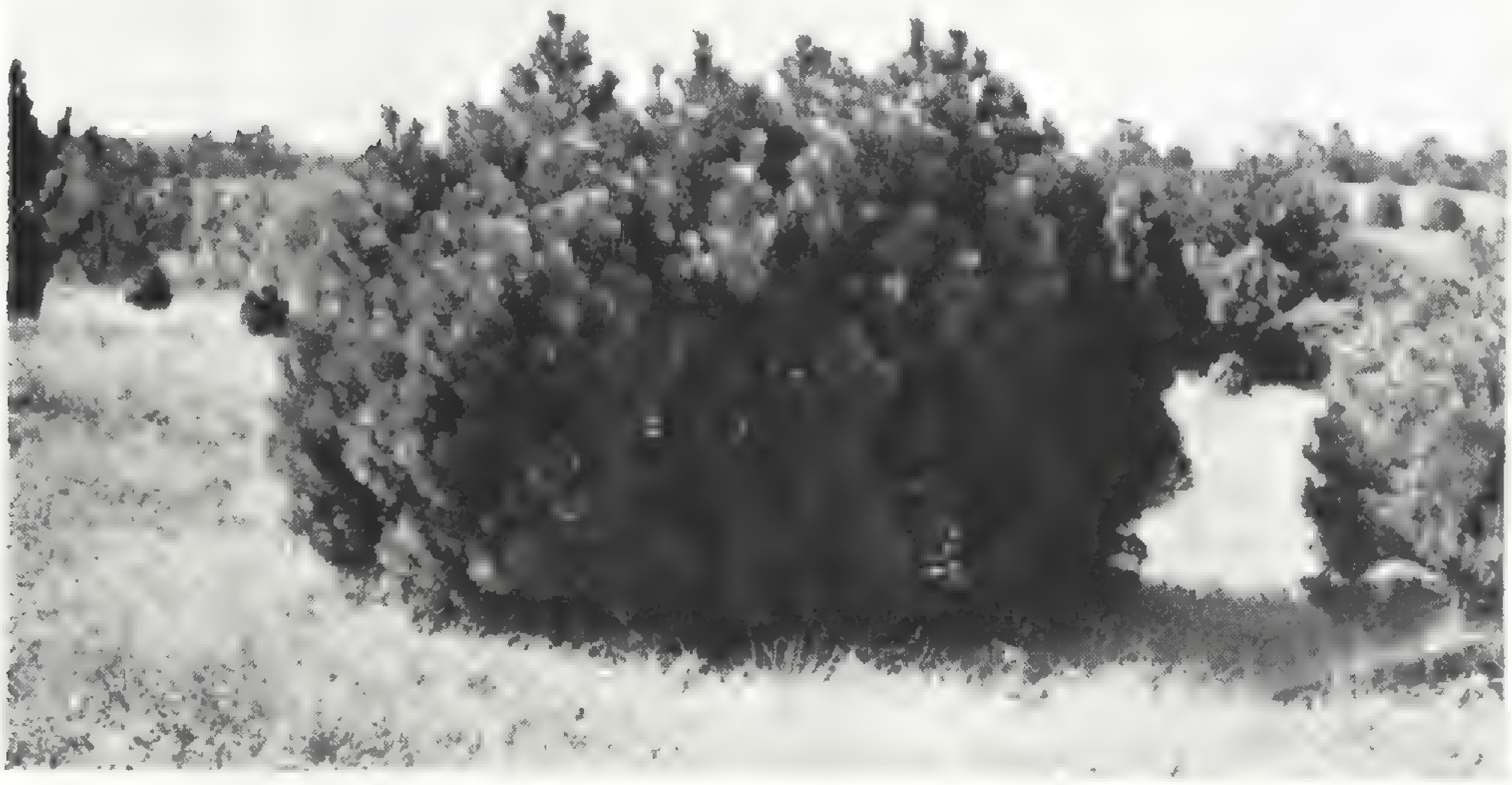
Group of Japanese Red Pines at the Missouri Botanical Garden Arboretum, Gray Summit, showing desirability of this species for screen planting.

Japanese Red Pine *(Pinus densiflora)*.—This species, a native of the rocky hillsides in Japan, has so far made better growth than any of the other pines in the Arboretum. It has soft, yellow-green needles which are held at different angles on different branches, giving the whole tree a somewhat shaggy and unkempt appearance. As the tree matures it nearly always acquires a rather picturesque wind-blown shape to the trunk and main limbs. This is so pronounced as to make the tree undesirable in certain formal plantings but in other gardens it might be worth growing for that very reason. So far it looks very promising for St. Louis, though it must again be emphasized that a long-time test is necessary before one can give unqualified recommendations to exotic conifers.



Eight-foot specimen of Japanese Black Pine which has been transplanted recently at the Missouri Botanical Garden Arboretum, Gray Summit.

Japanese Black Pine *(Pinus Thunbergii)*.—In many ways this is quite similar to the Japanese Red Pine but it has longer, stiffer needles and an even more picturesque, Japanesque appearance. It often looks like a small Austrian Pine which had been grown in a very windy spot. In the East this pine is being very much planted in such seaside parkways as Jones Beach on Long Island, for it is very resistant to damage from salt water. Plants which are resistant to salt are often resistant to drought as well, and it may very well be that the Japanese Black Pine will continue to prove as good a pine for St. Louis as its preliminary tests have indicated. In planting it one should remember that it is given to assuming odd positions and that the main stem will sometimes be closer to the horizontal than to the vertical for a good part of its length.



Mugho Pine. This symmetrical specimen growing at the Missouri Botanical Garden Arboretum, Gray Summit, is 15 years old but has not yet reached 5 feet in height.

Mugho or Mountain Pine *(Pinus Mugo)*.—This is the dwarf mountain pine of Europe, and it occurs in a number of forms ranging from small trees to large, dense shrubs. The one most commonly seen is quite shrub-like and almost globular in outline, growing so slowly that even very old specimens are scarcely shoulder-high. They are very much used for foundation plantings and deservedly so, for they look attractive as soon as they are set out and they do not grow out of the picture as do many other evergreens which are being used for this purpose. In planting the Mugho Pine in St. Louis it should be remembered that they tend in this climate to be rather short-lived. In the North and East they often grow to be very old trees, but we have seen none in the St. Louis neighborhood which are very much older than our specimens at the Arboretum.

Southern Yellow Pine *(Pinus echinata)*.—Since this tree is native to a good portion of southern Missouri it might be supposed that it would be one of the best evergreens to plant in the St. Louis area. Strangely enough, it is one of the most difficult species to get established. For reasons which are as yet obscure it does not transplant at all easily, and although there are scattered specimens growing within thirty miles of the city few gardeners who have attempted to grow the trees in the neighborhood of St. Louis have succeeded in bringing them through the first winter. The Garden has representatives of this species in its arboretum at Gray Summit and has started a series of experiments which may throw some light on its peculiarities.

FIRS AND SPRUCES

The firs and spruces are alike in having short needles, and branches and branchlets so regularly arranged that young trees look almost like toys. They are the kind of evergreens most commonly used as Christmas trees, and in the North their towering spires are one of the most beatiful features of a good pinetum. Unfortunately, most of them do not take kindly to hot summers and dry winds. Of the firs only the following one can be given a general recommendation for St. Louis.

Silver Fir or Colorado Fir *(Abies concolor)*.—This species is widely distributed in the western states, and in buying it one should make sure that he is getting one of the varieties from the drier part of its range in Colorado and not one from the Pacific Coast. While the needles of different varieties vary somewhat in their whiteness they are all more or less silvery. They are unusually long and widely spaced for fir needles, so that they sometimes look almost like pine and give a rather odd appearance to young specimens.

Norway Spruce *(Picea Abies)*.—Among the spruces this species has been the one most commonly planted. It is very attractive when young and makes a thrifty-looking little Christmas tree for ten to twenty years, after which in this climate it becomes increasingly ragged and unsightly until it eventually dies. They are therefore only to be recommended in plantings made for immediate effect.

COLORADO SPRUCE *(Picea pungens)*.—Probably the most popular spruce with amateurs in the St. Louis area is one of the "blue" varieties of the Colorado Spruce. Most representatives of this species have a more or less bluish cast to their stiff sharp needles, and several varieties such as "Koster's Blue Spruce" have been selected and introduced because of the extremely blue-white color. Gardeners who do not care for such bizarre trees should know that there are also Colorado spruces which are only faintly blue and that they are among the best spruces for this climate. In planting this species it should be remembered that it eventually makes a very large tree and while it may look well next to the doorstep for a year or two it will eventually appear badly overgrown in such a spot.

BLACK HILLS SPRUCE *(Picea glauca densata)*.—A variety of the Northern White Spruce which was originally native to the Black Hills gives promise of becoming the best spruce for general planting in this area. It is now available in various sizes at moderate prices from most nurseries, and while it has not yet been given a thorough trial, preliminary results are very promising. As a young tree it is rather similar to the much more commonly planted Norway Spruce but has finer, softer needles and a slightly denser habit of growth.

SERBIAN SPRUCE *(Picea Omorika)* is fortunately becoming generally available in the trade, though still rather expensive. Since it comes from a climate rather similar to our own and since it has done well wherever it has been grown in eastern North America, it is a promising new species for trial by the discriminating gardener. Though slow-growing, it eventually becomes a tall spire-like tree, its short, curving branches giving it a pagoda-like effect. The needles are silvery-gray below and dark green above and produce a beautiful display when they sway in the wind. Two other exotic spruces worth trying if they can be obtained are the Oriental Spruce *(Picea orientalis)* and Tigertail Spruce from Japan *(Picea polita)*.

Douglas Fir *(Pseudotsuga taxifolia)* may well be included here though technically it is neither a spruce nor a fir (as might be apparent even to an uninformed amateur by its strange cones whose long protruding bracts make them look like artificial Christmas tree ornaments). If one takes the precaution of dealing with a good nurseryman and as a consequence gets one of the strains which are hardy in the Middle West, this makes the quickest growth of any of the spruce-like evergreens. One or two excellent named varieties, differing in color and habit, are on the market and are worth the special effort required to obtain them.

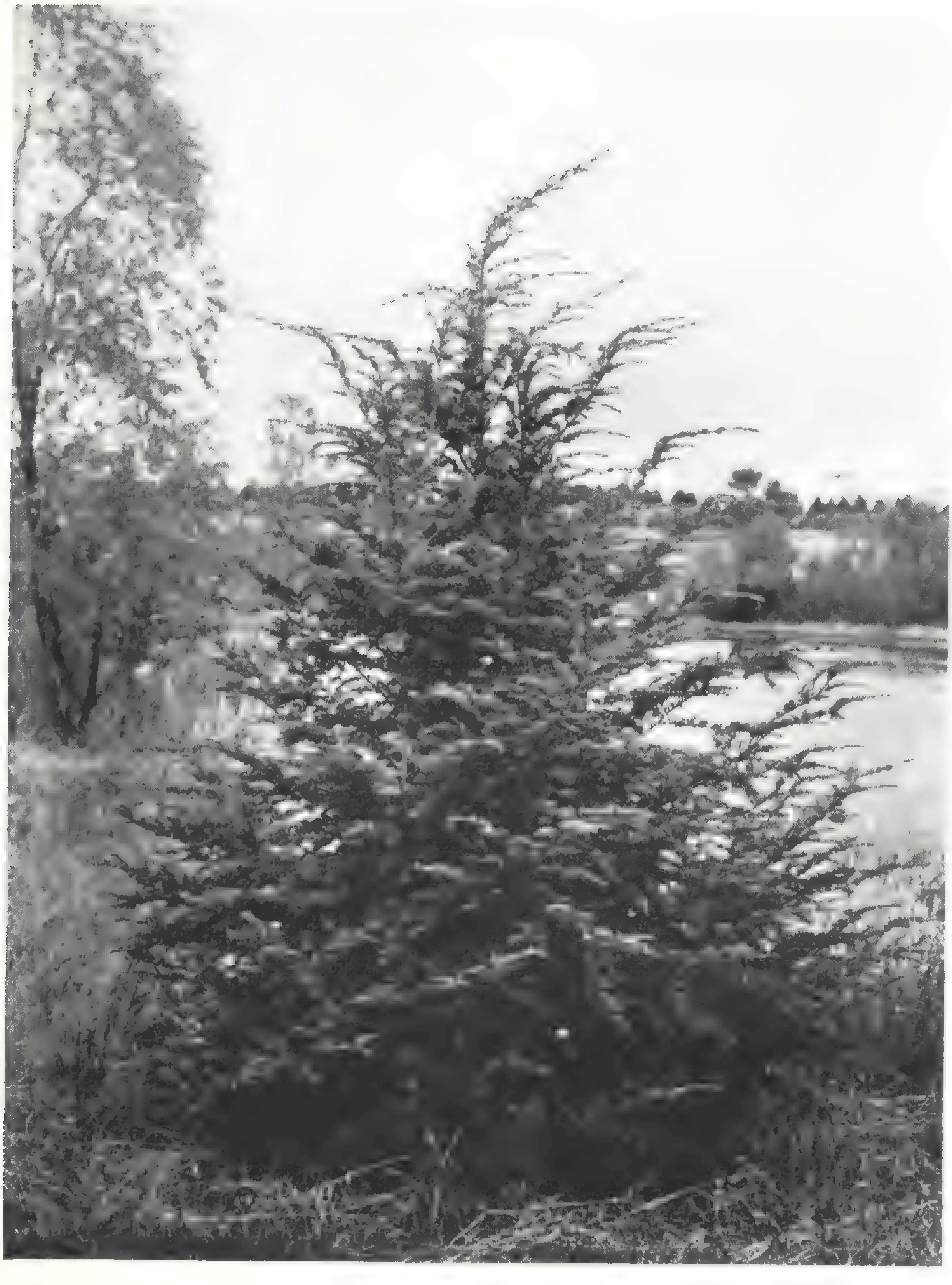
HEMLOCKS

Canada Hemlock *(Tsuga canadensis)*.—Unfortunately, this beautiful and picturesque conifer does not take kindly to our climate. Young plants are generally thrifty and graceful, but by the time they reach twenty or thirty feet in height they usually die during a hot summer. However, the tree is worth planting for temporary effect and if it can be shielded from hot dry winds (as at the base of a north slope) it may survive much longer.

Carolina Hemlock *(Tsuga caroliniana)* objects more strongly to middle-western conditions than does its northern cousin, *T. canadensis,* and cannot be recommended even for temporary effects.

ARBORVITAE

There are two kinds of Arborvitae commonly grown in middle-western gardens, the native American Arborvitae, *Thuja occidentalis,* and the Chinese Arborvitae, *Thuja orientalis.* Each is available in a large number of horticultural forms, dwarf, globe-shaped, pyramidal, golden-leaved, crisped-leaved, and peculiar varieties with feathery foliage. Though they are sold by nearly every nursery dealing in evergreens in this area, we cannot wholeheartedly recommend any of them for the St. Louis region. The American varieties burn in hot weather and should only be planted in sheltered situations. The Chinese varieties are very attractive when young. Their fern-like leaves are borne in flat, vertical



A young, healthy plant of Canada Hemlock growing in a protected location at the Missouri Botanical Garden Arboretum, Gray Summit.

sprays and are usually bright green in color unless bronzed by the winter sun. For temporary effects (such as filling up window-boxes during the winter) they are excellent. Well-established plants get more ragged in appearance every year and most old specimens are positive eye-sores.

YEW

Several species and varieties of dwarf yews (Taxus) are available in the trade but they all look very much alike. They are low bushes, spreading or upright, with broad, dark green needles and green branchlets which give the plant a dense, dark-green, formal aspect. They are expensive to buy, they need to be sheltered from the hot sun and from severe winter winds, and they require careful attention, but they are among the aristocrats of the plant world and are worthy of these special efforts. In St. Louis they have proved comparatively resistant to smoke. The foliage sometimes burns during hot summers, particularly on plants in exposed situations. Mulching with cow manure in the early summer will lessen the effect of this burning or may even prevent it altogether.

JUNIPERS

Junipers (Juniperus) are spiny-foliaged evergreens, whose small fleshy cones have more the appearance of a blue or brownish berry than of a cone. Most of them are bushy and a few trail on the ground; our native Red Cedar (technically a Juniper) is one of the largest and most tree-like. As a group these evergreens are well-suited to the St. Louis area. They are resistant to smoke and are tolerant of hot winds, dry soil, and sudden changes of climate. The differences between many of the species are obscure and technical, and low-growing horticultural varieties of one species will look more like similar forms of another species than they do like upright strains of their own. Since there are a very large number of varieties available in the trade, we shall discuss them by growth types rather than take them up one species at a time.

Big Upright Junipers.—

Our native Red Cedar, *Juniperus virginiana,* is an exceedingly variable species as any gardener may find out for himself by going out to a rocky hillside in the Ozarks and studying the amazing variation in growth form and leaf color which are to be found there. If he then orders eastern and northern varieties which are in the trade he will find another whole set of variations, for Red Cedars (like human beings) are made up of quite distinct races, and there are differences from race to race as well as from individual to individual.

Not all of the varieties of the Red Cedar do equally well with us, but by and large it is our most reliable species, as we might well have suspected since it is the only conifer native to the St. Louis area. It supplies us with our largest and most tree-like junipers, the variety "Cannarti," with dark green foliage somewhat irregularly bunched on the branches, and the variety "glauca," whose foliage is a silvery green. There are a number of these silvery or "blue" varieties in the trade, though some of them belong more properly to *Juniperus scopulorum,* an exceedingly variable species native to the Rocky Mountain area. Just exactly which of these varieties belong to *Juniperus virginiana* and which to *Juniperus scopulorum* it is difficult to say. Our native Junipers are badly in need of careful study and the relationships of the species and their various races are very poorly understood as yet.

LARGE BUSHY JUNIPERS—

PFITZER JUNIPER *(Juniperus chinensis Pfitzeriana).*—This variety grows quickly into a broad shaggy bush, with fine, dark green foliage. In St. Louis it is one of the most robust evergreens and has proved more resistant to smoke than any other kind.

VON EHRON JUNIPER.—Authorities disagree as to whether this interesting Juniper should be classed as a variety of *Juniperus virginiana* or of the European *J. Sabina.* It is so extremely vigorous that we have wondered if it may not possibly be a hybrid between the two. In the Missouri Botanical Garden Arboretum at Gray Summit it has given a fine account of itself and shown what a magnificent plant it is capable of making when given plenty of room. The von Ehron Juniper has no central trunk but the long slanting branches grow up to the height of a small tree. While it has not been in cultivation very long in this country, it is now available in the trade and should be used much more freely. It should not, however, as it sometimes has been, be tried for foundation planting. While it will look very well close to a building for the first few years it will eventually grow so rampantly that it will have to be cut back repeatedly and severely.

A well-developed specimen of the von Ehron Juniper in the Missouri Botanical Garden Arboretum, Gray Summit. The long ascending branches are characteristic of this variety.

Meyers Juniper *(Juniperus squamata Meyeri)*.—This Chinese Juniper is one of the most distinctive varieties available for this area. It forms a picturesque bush with spiny, bluish foliage arranged in irregular bunches. It is often rather bare-branched at the base, and old specimens look their best at the back of a collection with lower-growing sorts in front.

Low Junipers—

Common Juniper.—This is the common spiny Juniper which grows in such abundance in old New England pastures. In most varieties there is no upright tree-like main stem but the branches sweep upward from the ground in wide fans, like the flames of a grass fire. There are a number of named varieties which differ in the color of their foliage or their habit of growth.

TAMARIX JUNIPER *(Juniperus Sabina tamariscifolia)*.—This is a beautiful little plant with an irregular, bushy habit of growth. Unfortunately, it is quite susceptible to the Juniper blight and cannot be given as general a recommendation as it would otherwise deserve.

WAUKEGAN JUNIPER *(Juniperus horizontalis Douglasii)*.—This is a selected form of the prostrate juniper which makes broad mats of foliage in sandy places around the Great Lakes. As its name implies, it was collected at Waukegan, Illinois, where the display of these native junipers is unusually beautiful. In winter its foliage acquires a purplish cast which contrasts beautifully with some of the other dwarf varieties when planted nearby.

BAR HARBOR JUNIPER.—This is another variety of *Juniperus horizontalis.* It has steely blue foliage and makes a low compact mat of foliage.

Juniperus chinensis Sargenti.—This is a prostrate variety of the Chinese Juniper which is nearly as low as the varieties of *Juniperus horizontalis.* It has a rich green, almost feathery foliage, and old plants which have covered a considerable area are particularly attractive.

JAPANESE JUNIPER.—This beautiful little plant has the misfortune to travel under a variety of names. Nurserymen and botanists alike have been unable to make up their minds as to where it should be classified, and it has been known as *Juniperus japonica, J. chinensis japonica,* and *J. chinensis procumbens.* Whatever its proper name, it is one of the best, if not the best, low juniper for this region. It has sharp, gray-lined needles bunched in tiny rosettes. There are variations available in the trade with even more dwarf growth and with golden-tipped foliage.

While this by no means exhausts the catalogue of coniferous evergreens which might be grown in St. Louis, it does include all those which have stood the test of time and are known to have made a creditable showing in our drought years. The Garden is also experimenting with broad-leaved evergreens, particularly with the hardier varieties of box, but a discussion of them must be left for a later bulletin.

EDGAR ANDERSON,
A. P. BEILMANN,
ROBERT B. CLARK.

WINTER COURSE IN GARDENING FOR AMATEURS

A course in gardening for amateurs, calculated to give the students as much practical work as possible, will start in February, 1942. The classes will be held in the experimental greenhouses, Tuesdays and Thursdays, 10:00 to 12:00 a.m. In order to give maximum individual instruction each class will be divided into two sections, one group meeting on Tuesday and the other on Thursday. Students may elect either one of the two days. Those who have previously had the course may be enrolled provisionally, but cannot be insured a place in the class unless the number of new registrants permits. The course will be in charge of Dr. Fairburn.

REGISTRATION: It is desirable that registration be made by letter, with check enclosed payable to the Missouri Botanical Garden, as soon after January 1 as possible. Please indicate preference as to day. Tickets will be distributed at the experimental greenhouses on day of first lecture.

FEE: The registration fee is $15.00 per student, and tickets are not transferable.

OUTLINE OF GARDENING COURSE

February 3 and 5—
The selection and care of house plants. Special exhibit of dependable plants for home use. Methods of forcing bulbs into flower during winter.

February 10 and 12—
The relation of soil to plant growth. Preparation of fertile garden soil and methods of testing fertility.

February 17 and 19—
How to improve soils by the use of fertilizers.

February 24 and 26—
Identification and control of common garden insects and diseases.

March 3 and 5 to March 31 and April 2—
Plant propagation. Five class periods will be devoted to this important phase of gardening in order that the students may become familiar with a wide variety of plants and practice raising them from seeds and cuttings.

April 7 and 9—
Students will pot up plants raised from seed.

April 14 and 16—
Students will pot up plants raised from cuttings.

April 21 and 23—
Landscaping the home grounds. Preparation and care of lawns.

April 28 and 30—
Garden work demonstrated:
- Pruning trees and shrubs.
- Transplanting trees, shrubs, perennials.
- Digging and preparing flower beds.
- Application of lime and fertilizers.
- Planting annuals and perennials.
- Cultivating.
- Spraying.

May 5 and 7—
Trip to the Garden Arboretum at Gray Summit, Mo., where the students will have an opportunity to see the large collection of orchids, many specimen evergreen trees, wild flowers, trails and general development of this 1600-acre tract of land.

NOTES

Dr. Edgar Anderson, Geneticist to the Garden, was chairman of the botany tours at the nature field days of the Pere Marquette State Park, Grafton, Illinois, October 25 and 26.

Dr. David C. Fairburn, Horticulturist to the Garden, gave an illustrated lecture, "The Selection and Care of House Plants," before the Des Moines Garden Club, Des Moines, Iowa, October 9.

On October 10, Dr. Fairburn gave a talk on "The Missouri Botanical Garden," illustrated with colored moving-pictures, to the members and students of the horticultural staff of Iowa State College, Ames, Iowa.

During the severe electrical storm, on October 22, one of the old cypresses at the Garden planted in Mr. Shaw's time was struck by lightning and the upper portion of the tree was completely shattered.

Mr. George H. Pring, Superintendent of the Garden, acted as one of the judges, October 28, of the tulip-trees presented last spring to the school-children of St. Louis and county by Mr. John S. Swift, prizes being awarded for the best trees.

Mr. Ladislaus Cutak, in charge of Succulents at the Garden, has given the following lectures recently: October 17, "Plants of Old Mexico," before the Delphinium Circle of the Rosemary Garden Club; November 12, "Gardens of Florida," before the Holy Name Society, St. Pius Branch; November 14, "Cacti Make Good House Plants," before the Better Gardens Club.

Recent visitors to the Garden include Mr. Robert M. Senior, of the Cincinnati Natural History Society, and Mrs. L. E. Randall, of Dallas, Texas. The latter, a greatniece of Julien Reverchon, was particularly interested in the Garden herbarium since it includes the principal collections of her uncle. Trained in France, he came to Texas in 1855, at the age of 18 or 19, and was one of the pioneer botanists to make extensive collections in that region.

The September number of the Bulletin, which, it will be remembered, was devoted to an article on "Historic Trees of Missouri," by Miss Stella Michel, a teacher in the St. Louis public schools, has been very widely copied. Besides the *Kansas City Times* (September 26) and the October number of the *Missouri Historical Review,* it was reprinted in part in the *Waterways Journal,* a periodical devoted to news of our inland waterways, where it shared a page with news of river pilots and a query concerning the naming of river boats.

STATISTICAL INFORMATION FOR OCTOBER, 1941

Garden Attendance:	
Total number of visitors	29,669
Plant Accessions:	
Total number of plants and seed packets received as gifts	1,212
Library Accessions:	
Total number of books bought	10
Total number of books and pamphlets donated	55

HERBARIUM ACCESSIONS:

By Purchase—	
Woodson, Robert E.—Plants of Panama, collected by H. von Wedel	563
By Gift—	
Anderson, Edgar—Plants of Missouri	29
Berry, E. C.—Plants of Missouri	9
Carnegie Institution of Washington, by David D. Keck—Plants of California	88
Caum, E. L.—*Stemmadenia Galeottiana* (A. Rich.) Miers	1
Cory, V. L.—Plants of Texas	5
Cutler, Hugh C.—Plants chiefly from Mexico	52
Fairburn, D. C.—*Lespedeza formosa* Koehne, from Horticulture	1
Gilbert, F. A.—*Iris virginica* L. var. *Shrevei* (Small) Anders.	1
Hutton, Mrs. L. D.—*Geaster* sp. from Missouri	1
James, Leslie—Plants of Alabama	12
Lee, Archie—*Quercus myrsinaefolia* Bl., from Georgia	1
Lenz, L. W.—*Lepiota procera* Fr., from Missouri	1
Norton, Mrs. C. E.—*Parmelia* from Maine	2
Reynolds, H. C.—*Chenopodium gigantospermum* Aellen from Illinois	1
University of Michigan—Plants of South Carolina, Mexico and British Honduras	10
By Exchange—	
Ames Herbarium, Harvard University—Orchids of Mexico	2
Brenckle, J. F.—Plants of North and South Dakota	66
Daily, William A.—Myxophyceae from Kentucky, Ohio, etc.	59
Field Museum of Natural History—Plants of Guatemala	53
Gould, Frank W.—Plants of California	147
New York State Museum, Albany—Plants mainly from New York	250
University of Michigan—Plants of India	179
By Field Work—	
Anderson, Edgar—Plants of Mississippi	30
Total	1,563

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Field Museum Notes

For sale by the Missouri Botanical Garden. Price $3.00

MISSOURI BOTANICAL GARDEN BULLETIN

Vol. XXIX DECEMBER, 1941 No. 10

MISSOURI BOTANICAL GARDEN
1889

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President of The Academy of Science of St. Louis

JOHN A. FLEISCHLI
President of the Board of Education of St. Louis

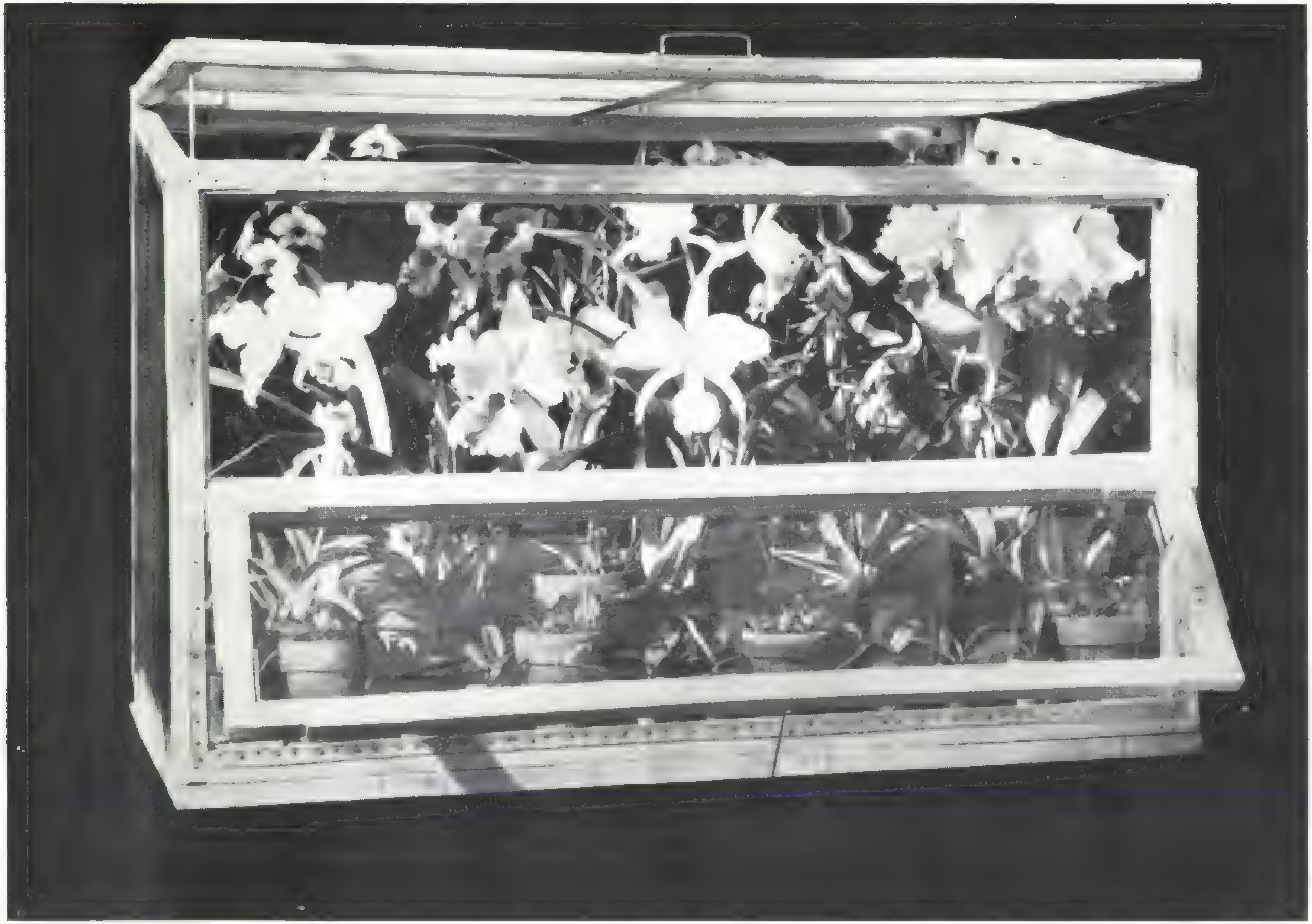
Secretary
GERALD ULRICI

SOME FACTS ABOUT THE GARDEN

The Missouri Botanical Garden was opened to the public by Mr. Henry Shaw about 1860. From that date until his death in 1889 it was maintained under his personal direction. Although popularly known as "Shaw's Garden" the name Missouri Botanical Garden was chosen by Mr. Shaw and he definitely indicated that he wished it called by that name. The Garden passed at his death into the hands of a Board of Trustees, designated in Mr. Shaw's will, and the Board so constituted, exclusive of certain ex-officio members, is self perpetuating. By a further provision of the will the immediate direction of the Garden is vested in a Director, appointed by the Board. The Garden receives no support from city or state but is maintained almost exclusively from the estate left by Henry Shaw. Since 1939 many Garden Clubs and interested individuals have contributed to a "Friends of the Garden Fund" which is used in developing the new Arboretum, located at Gray Summit, Mo. The Arboretum (1) serves as a source of plants, trees and shrubs for the city Garden; (2) affords areas for gradually establishing a pinetum, a wild-flower reservation and various other features on a scale not possible in the city; (3) provides greenhouses for some 20,000 orchid plants.

The city Garden comprises 75 acres, where about 12,000 species of plants are grown, both out of doors and under glass. It is open every day in the year except New Year's Day and Christmas; week days, 8:00 a. m. until sunset; Sundays, 10:00 a. m. until sunset. The greenhouses are closed every day at 5:00 p. m.

The main entrance to the Garden is at Tower Grove Avenue and Flora Place, on the Sarah car line (No. 42). The Tower Grove bus (No. 21) direct from downtown, passes within three blocks of the main entrance.



Wardian Case made of Lumarith. Orchids illustrated are: *Cattleya Trianae*, Laeliocattleyas, hybrid Cattleyas, Cypripediums, Dendrobiums and young seedling Cattleyas in small pots. We might label this "An Amateur's Midnight Dream."

Missouri Botanical Garden Bulletin

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HOUSE PLANTS

Every home needs a few plants. When used properly, they add the finishing touch to the appearance and general atmosphere of a room that otherwise might seem rather dull or even dead. Apparently this fact is well known for in most houses and apartments some form of indoor gardening is attempted. Frequently the results are not very impressive and at times a person may be tempted to give it up as a hopeless proposition. Of course, occasional failures will occur even under the best of conditions, but in the majority of cases difficulties arise from lack of adequate information on the subject. Some people have what is commonly known as "green fingers," or the magic touch that puts vim, vigor and vitality into a plant. They can grow almost anything with no apparent effort. How do they do it? Let us examine the secrets of success in order of their respective importance.

1. SELECT THE RIGHT KINDS OF PLANTS.—This recommendation tops the list because what follows may be entirely useless if good judgment is not exercised at the very beginning. There are many kinds of plants that absolutely will not respond favorably when exposed to the environmental conditions of the average house. Plants are like people—they differ greatly in ability to withstand adversity. Specimens with tough, leathery leaves and stems are the most tolerant of poor growing conditions. For example, Rubber Plant (Ficus), Cast-iron Plant (Aspidistra) and Mother-in-law's Tongue (Sansevieria) will flourish where Gardenias, Roses and Orchids would fail miserably. There are so many different kinds of house plants available that it is rather a

difficult problem for beginners to choose the ones best suited to their needs. If these plants are segregated into several groups according to their growth habits, sturdiness, rarity, etc., the problem of selection becomes less complicated. These groupings appear on subsequent pages.

2. Dry Air accounts for many failures. In a greenhouse the relative humidity usually averages over 60 per cent, but in homes not equipped with air-conditioning apparatus it seldom exceeds 30 per cent except in the kitchen, bath or laundry. So, when certain kinds of plants are transferred from a moist greenhouse, or even from the garden, into the desert-like atmosphere of superheated houses, it is not surprising that leaves curl up, flower-buds shrivel and drop off and final collapse often occurs.

There are several ways to increase the moisture in the air. Shallow metal trays or pans of water placed on radiators when the heat is on insures quite rapid evaporation. A tray of moist gravel on a window sill or table makes a good base on which to put potted plants as it prevents the soil from drying out quickly and raises the humidity around the leaves where it is needed most. About once a week house plants should be placed under the shower, and given a thorough spraying with cool water. This improves the moisture situation and also removes dust, soot, etc., which accumulates so rapidly in the city. Do not spray African Violets or Gloxinias, as water on the leaves tends to cause yellow spots and mottling, especially if the plants are exposed to direct sunlight while still wet. During winter the water reservoirs on hot-air furnaces should be kept filled constantly. On mild days open doors and windows to completely air out the house. Frequently, a slight gas leak in heating or cooking apparatus causes plants to wilt and drop their leaves, so a bit of fresh air may be very beneficial.

3. Sunlight is absolutely necessary for plants to manufacture their food in the leaves and stems. If the light is inadequate they eventually suffer from starvation, and no amount of external treatment with fertilizers or vitamins will relieve the situation. In winter the sunlight is not very intense, particularly in smoky cities. From a light-exposure standpoint the respective value of windows (unobstructed by trees, houses, etc.) is as follows: south, east, west, north. Plants in windows tend to grow toward the sun

and should be turned around every few days to retain their normal shape. Tall, spindly specimens (a condition caused by lack of direct sunlight combined with high temperature) should be pruned back severely to make them branch out near the base.

Floor-lamps with brackets for holding potted plants under the light are both attractive and practical, particularly during the dark winter months (pl. 56). Of course, table lamps serve the same purpose. A 100-watt bulb is about the right size to use, keeping the plants one to two feet away from the bulb to avoid heat radiation. It is folly, however, to assume that artificial light can entirely replace sunlight. Such an idea is nothing short of amusing when we realize that direct sunlight, even after it passes through window glass, is still over fifty times stronger than light one foot away from a 100-watt bulb. This means that it would require the combined illumination of fifty 100-watt bulbs to equal the strength of sunlight that filters into the house, if the windows are clean. In spite of commercial advertisements, inspiring photographs, etc., simple arithmetic indicates that a dark basement plus a few electric lights and vitamin B_1 adds up to mushrooms, not roses or even cabbages.

4. WATERING seems to cause a lot of trouble for many indoor gardeners. Some get in the habit of soaking the soil once a day regardless of what may be actually needed. Certain kinds of plants, as Callas, Cinerarias, Ferns, Umbrella Plants (Cyperus) and bulbs, enjoy abundant moisture at the roots, but Geraniums, cacti and all succulents (plants with thick, fleshy leaves) will not thrive in wet, soggy soil. Yellowing of the leaves, root rot and stem rot are symptoms of over-watering. On the other hand, there is nothing to be gained by letting the soil dry out until it feels like concrete. Water should be applied before the leaves show any sign of wilting. During winter, when the plants are not in active growth, keep the soil on the "dry side," especially with cacti and succulents.

When watering be sure to do a thorough job and see that the moisture penetrates down to the roots where it is needed. A mere sprinkle on the surface of the soil is practically useless. Immersing the pots in a pan of water for several minutes is a sure way to get results.

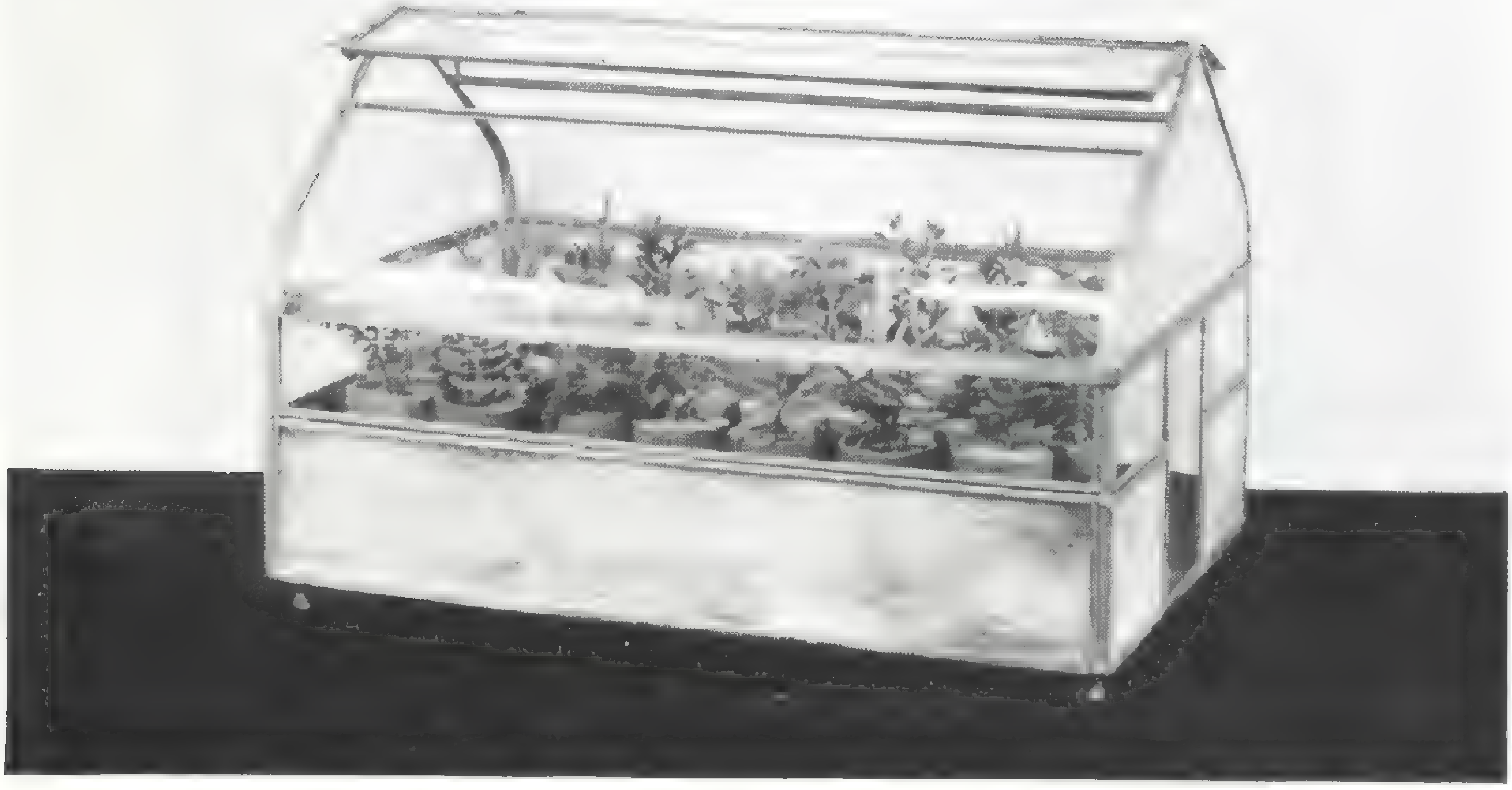
The following method of watering plants automatically may be found useful. A jar of water is placed next to the potted plant. Fold an ordinary paper towel into a strip about 1 inch wide and imbed one end firmly in the soil 2 inches deep. The other end of the towel is then dropped into the jar of water. The towel acts as a wick, drawing water over into the soil and keeping the plant well supplied until all the water in the jar is gone. If the flow is too rapid, reduce the thickness of the towel or do not fold so tightly. One quart of water will last a plant in a 4- to 6-inch pot a week or more, depending on the weather. When vacation time arrives, the problem of keeping the plants watered can be solved by arranging them around a tub of water and running a paper wick to each pot. This should take care of the situation for at least two weeks.

Florists are now featuring flower-pots equipped with built-in automatic watering devices. Such new ideas that reduce the amount of labor involved and eliminate the chances of error should make many indoor gardeners very happy.

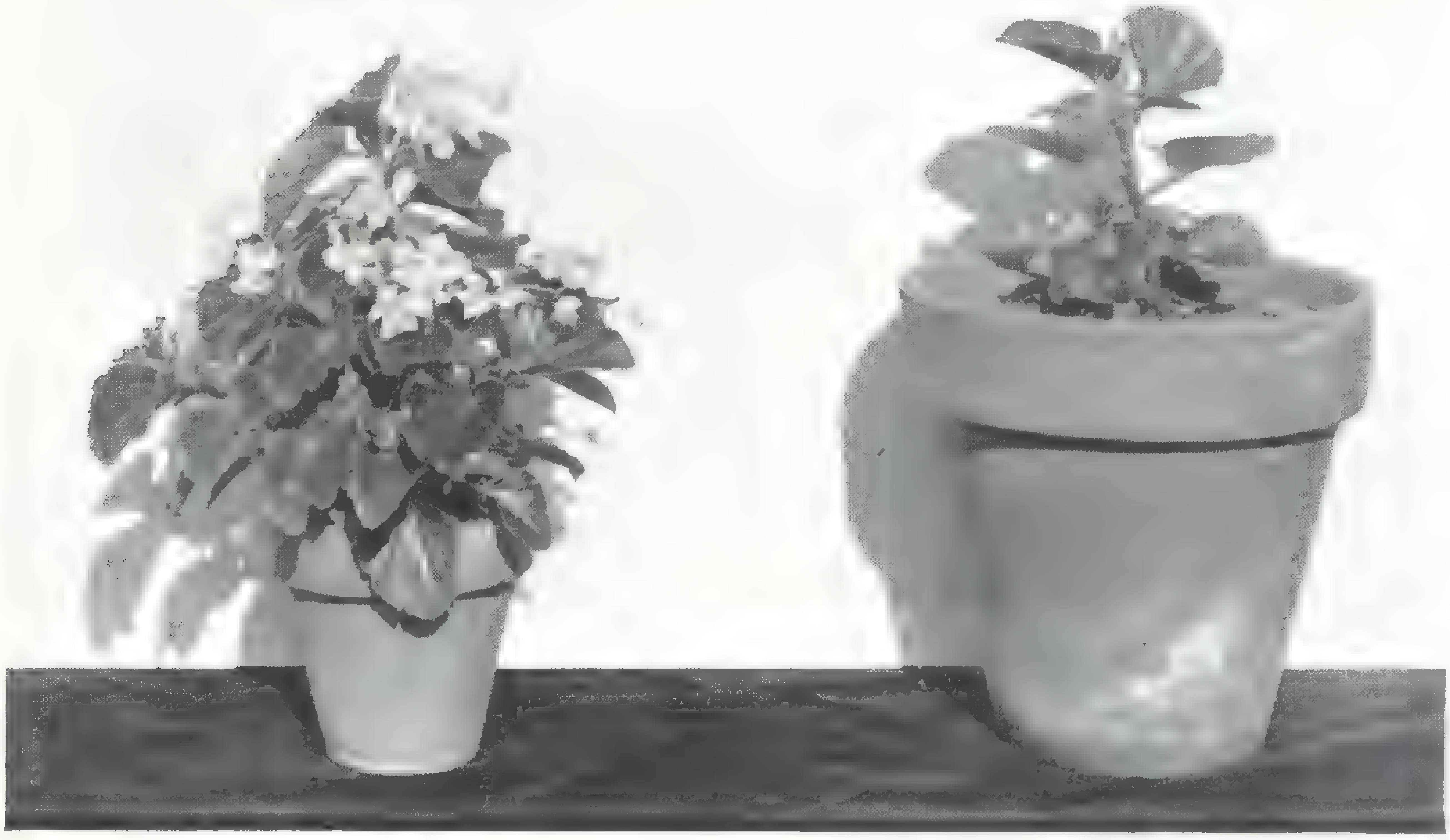
Another way to keep the soil in porous flower-pots from drying out quickly is to imbed the pots in moist peat or sphagnum moss. Window boxes and ferneries are often arranged this way, making it easy to substitute new plants whenever necessary. Small potted plants can be kept moist by placing them in larger pots lined on the inside with wet peat or moss. African Violets respond well to this treatment. The common practice of letting potted plants stand in flooded jardinieres or bowls of water is not recommended. The soil soon gets sour and roots rot off.

Rain-water is not always best for plants. Experiments at the Garden have shown that both rain and snow-water in St. Louis contain sulphur compounds in sufficient quantities to be definitely toxic. This, of course, is due to smoke which we hope can be entirely eliminated soon. Considerable progress has already been made in that direction and plants are showing a marked improvement in growth. Coal smoke causes a greasy soot accumulation on the leaves, reducing the amount of sunlight available for the manufacture of plant food. Consequently, it is impossible to raise many of the more sensitive plants in large cities.

5. TEMPERATURE is the next important item. For most plants, and people too, 72° F. is about right. Moderate variations of 10–20 degrees are not harmful, but extreme fluctuations are to be



A miniature greenhouse makes an attractive "Wardian Case" for dwarf plants.



Carmen Begonias. The one at the right illustrates the common mistake of using a pot far too large for the plant.

avoided. At night, when the plants are partly at rest, the temperature can be lowered 5–10 degrees. Primulas, Cyclamen, Violets and all hardy bulbs do best in a cool sun-room where it is 45°–60° F. Tropical house plants such as Dumb Cane (Dieffenbachia), Crotons, Chinese Evergreen (Aglaonema) and Rubber Plants require a warmer temperature of 70°–80° F.

6. Fresh Soil at least once a year is essential for nearly all potted plants except slow-growing cacti and succulents. A small pot of soil contains only limited amounts of plant food, and constant watering leaches out what soluble nutrients the roots do not absorb. Naturally, then, there comes a time when the old soil can no longer supply the roots with essential growth elements. The plant becomes "pot-bound," growth gradually ceases, leaves turn yellow and drop off. Specimens in this condition need shifting to larger pots, using a porous loam soil composed of about two parts garden soil, one part leaf-mold, peat or old stable manure and one part coarse sand. A teaspoonful of bone meal and an equal amount of complete fertilizer added to each 4-inch pot of prepared soil will stimulate growth.

Potting operations are not difficult. Simply remove the plant from the old flower-pot, loosen up the ball of soil a bit and repot in fresh soil, setting the plant slightly deeper in the new container. Firm the soil well, water thoroughly and shade for a few days. The size of pot used should be in proportion to the size of plant. A large plant in a small container makes an unbalanced arrangement, suffers from lack of moisture and soon shows signs of malnutrition. On the other hand, a small plant in an excessively large pot appears lost and usually is lost before long (pl. 52). A trip to the nearest greenhouse that handles potted plants should be very helpful to those who need guidance.

House plants can be grown in a variety of containers. Porous clay pots are the most satisfactory because they may be obtained in any size desired and there is less chance of over-watering. Glazed, metal, glass and composition pottery may be used if the soil is kept fairly dry. Plants in such containers should be watered only when the surface of the soil becomes dry to the touch. With all the empty tin cans that accumulate around homes today, it might be worth while to wash some out thoroughly, paint them various colors, punch a few holes for drainage and use them as flower pots. To me they would be far more artistic and practical than a lot of this fancy animal pottery that is flooding the market. Many a husky geranium has been raised in an old tomato can. The answer is fertile soil, full sunlight and not too much water at the roots.

7. FERTILIZERS must be used very carefully. Many of the commercial brands are highly concentrated and slight over-doses cause leaf burn or may even destroy the plant. It is far better to apply just a "pinch" of fertilizer every two or three weeks than to use larger quantities at longer intervals. Plants freshly potted in fertile soil do not need additional nourishment for several weeks, or months if they are the slow-growing kinds. Cacti and succulents require very limited fertilization, perhaps once a year or less. During winter when most house plants are semi-dormant no fertilizers should be applied, but when growth starts again in spring additional feeding is beneficial.

Lack of vigor and pale green to yellow leaves are symptoms of malnutrition. Liquid manure, prepared by mixing about ¼ pound of dry, shredded cattle manure with 1 gallon of water, makes a safe and very effective fertilizer. This solution is applied as a regular watering once every two or three weeks depending on the weather. When there is abundant sunshine, plants grow faster and can stand more fertilization than when it is cloudy.

Chemical fertilizers with percentages of available nitrogen (N), phosphorous (P) and potassium (K) totaling up to about 20 (4-12-4, 5-10-5, etc.) can be used safely in liquid form at the rate of 1 level teaspoonful of the fertilizer to 1 quart of water, each plant receiving ½ cupful of the solution every two or three weeks. These fertilizers can also be applied in powdered form, using 1 level teaspoonful or less for a plant in a 4- to 6-inch pot, stirring it well into the soil and then adding water. Never apply fertilizers when the soil is dry and avoid getting any of the powdered chemicals on leaves or stems as it generally "burns" them. Remember, a little bit goes a long way and too much will kill the plant.

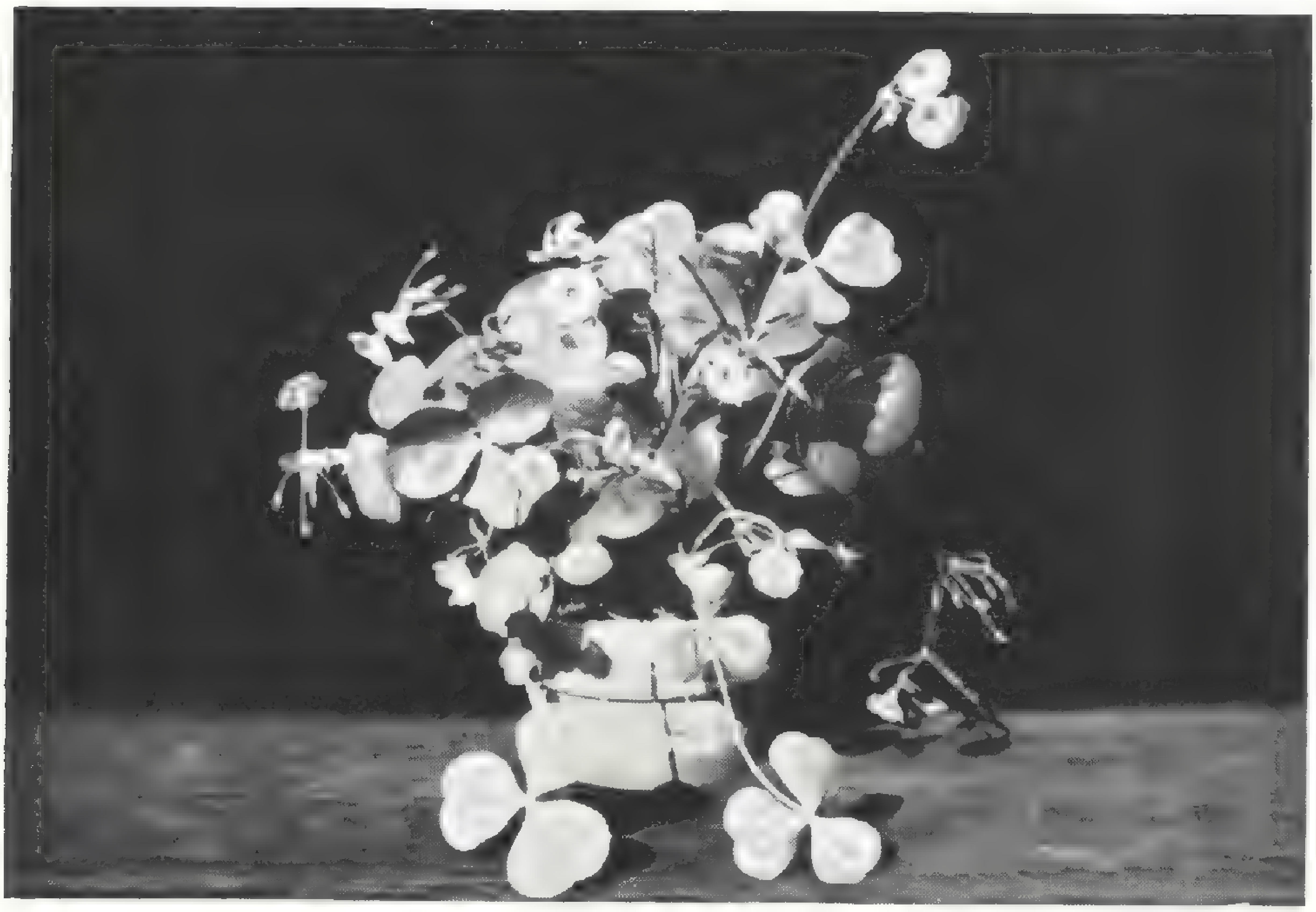
When raising Azaleas, Gardenias and Orchids, soil acidity (pH) is a very important factor. For the average run of house plants, though, it can be ignored if they are growing in a well-drained fibrous loam that contains a generous proportion of leaf-mold, stable manure or peat that is not highly acid. Most plants prefer a soil that is slightly acid in reaction (pH 6.0–6.5). As a rule, clay soils need a bit of lime, but when in doubt get an inexpensive testing kit at the seed store and become an "expert."

8. INSECTS AND DISEASES can be very destructive. It is a good idea to inspect the plants carefully about once a week to make sure no pests get well established. Always examine the lower side of each leaf, joints of the stems and other inconspicuous parts, except the roots which are not often molested. Nearly all insects can be removed by a forceful spray of cool water. Put the plants under the shower and spray them hard, especially on the under-sides of the leaves. Repeat this treatment at weekly intervals for complete control. Dipping the plants in a bucket of lukewarm soapy water also discourages many insect pests. These remedies are simple but effective.

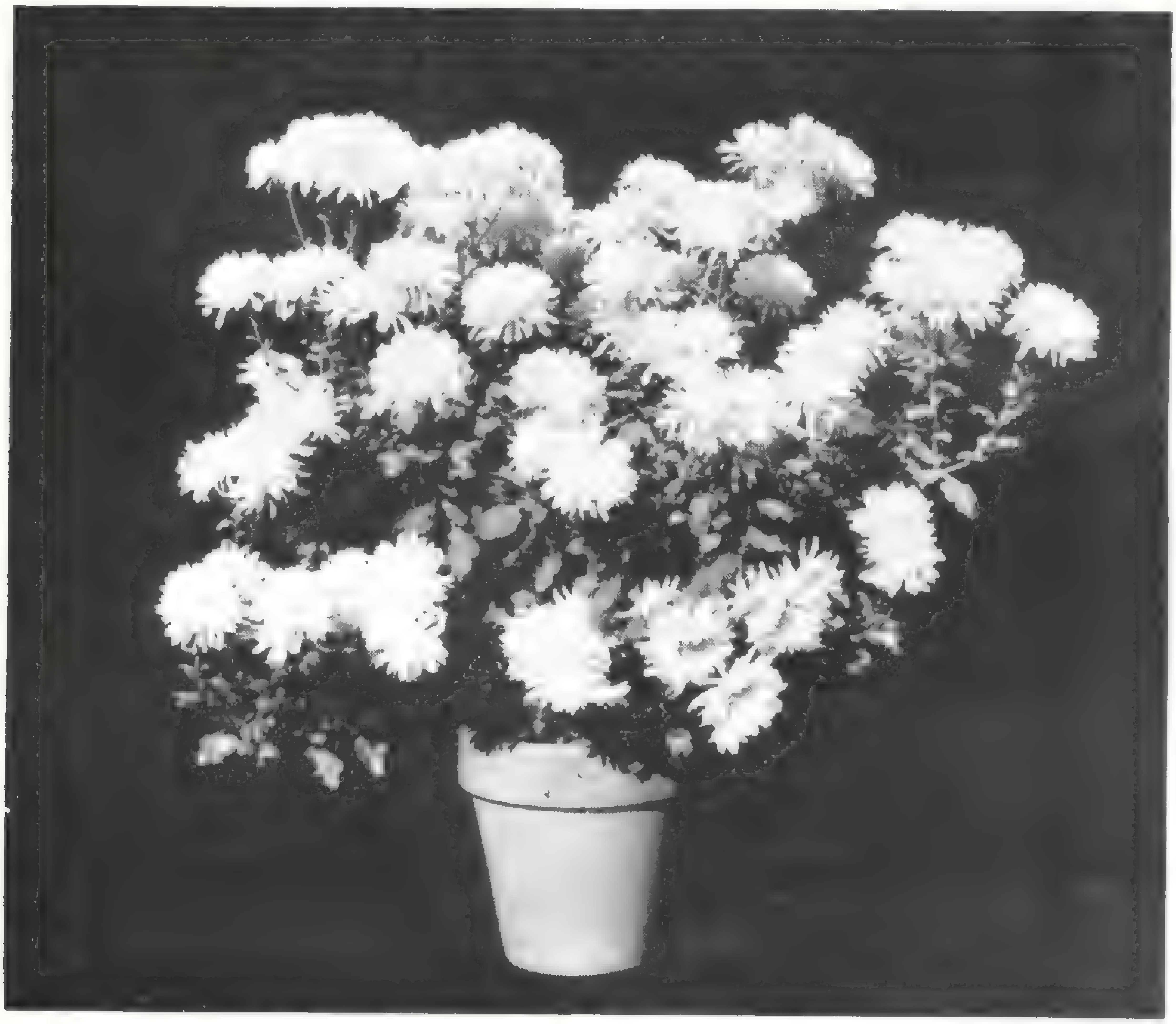
Insecticides can be purchased that will do the job too. For caterpillars, slugs, beetles, etc., that eat holes in the leaves, use a stomach poison such as arsenate of lead. This material must be sprayed on the plants carefully because it is toxic to man as well as bugs. Nearly all insects which prowl around on house plants during winter have sucking mouth parts like a mosquito. In this group are aphids (plant lice), mealy-bugs, white-flies, red-spiders (mites), thrips and scale insects. They puncture the leaves and draw out the sap. Infested leaves get speckled or flecked gray, turn yellow, curl up and drop off. Sucking insects cannot be eradicated by using arsenate of lead spray. They require a contact insecticide such as nicotine sulphate, pyrethrum extracts and rotenone. Scale insects are very resistant and it usually takes an oil spray to kill them. Nicotine sulphate will discolor flowers, but has no ill effect on leaves, except those of Violets. All sprays should be applied according to the directions on the containers to get proper results. If used too concentrated, they injure the plant.

Complete information on the "Identification and Control of Common Insect Pests" will be found in the following issues of the Garden BULLETIN:

December, 1939—Aphids
February, 1940—Mealy-bugs
March, 1940—Red-spiders
May, 1940—White-flies
June, 1940—Scale Insects



Oxalis Bowieana, the best of its kind. Large bright green leaves and many deep pink flowers.

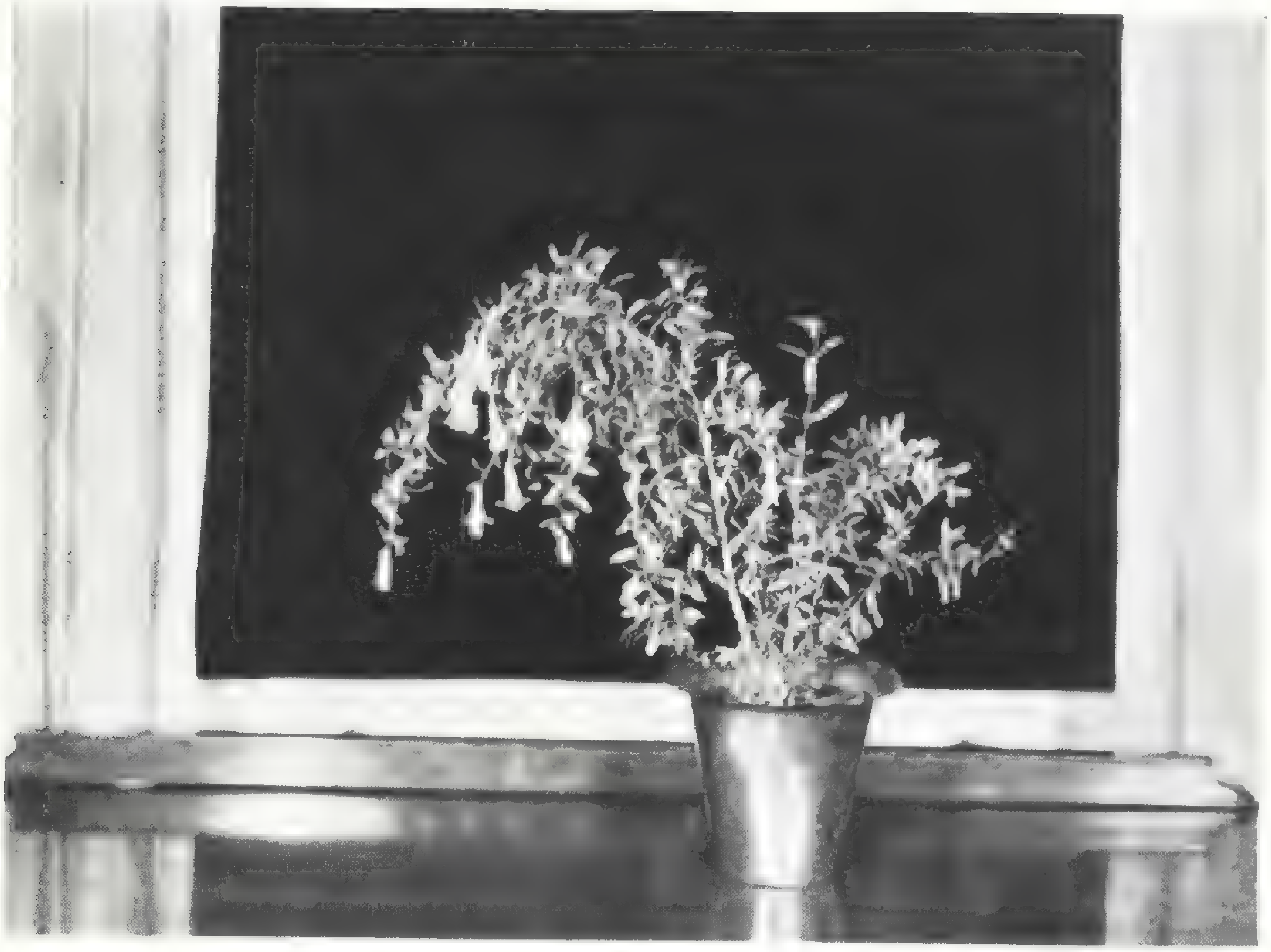


A bush chrysanthemum makes a showy house plant.

A diseased plant is usually a dead plant, and the sooner it is discarded the better. Diseases such as wilts, yellows, rots, leaf spots and mildew are caused by fungi which work mostly inside the plant tissues. Consequently, they are very difficult to combat. For mild cases where control might be effected, use dusting sulphur or bordeaux mixture. Preventive measures include good air circulation, abundant sunlight, low temperatures, and not too much moisture.

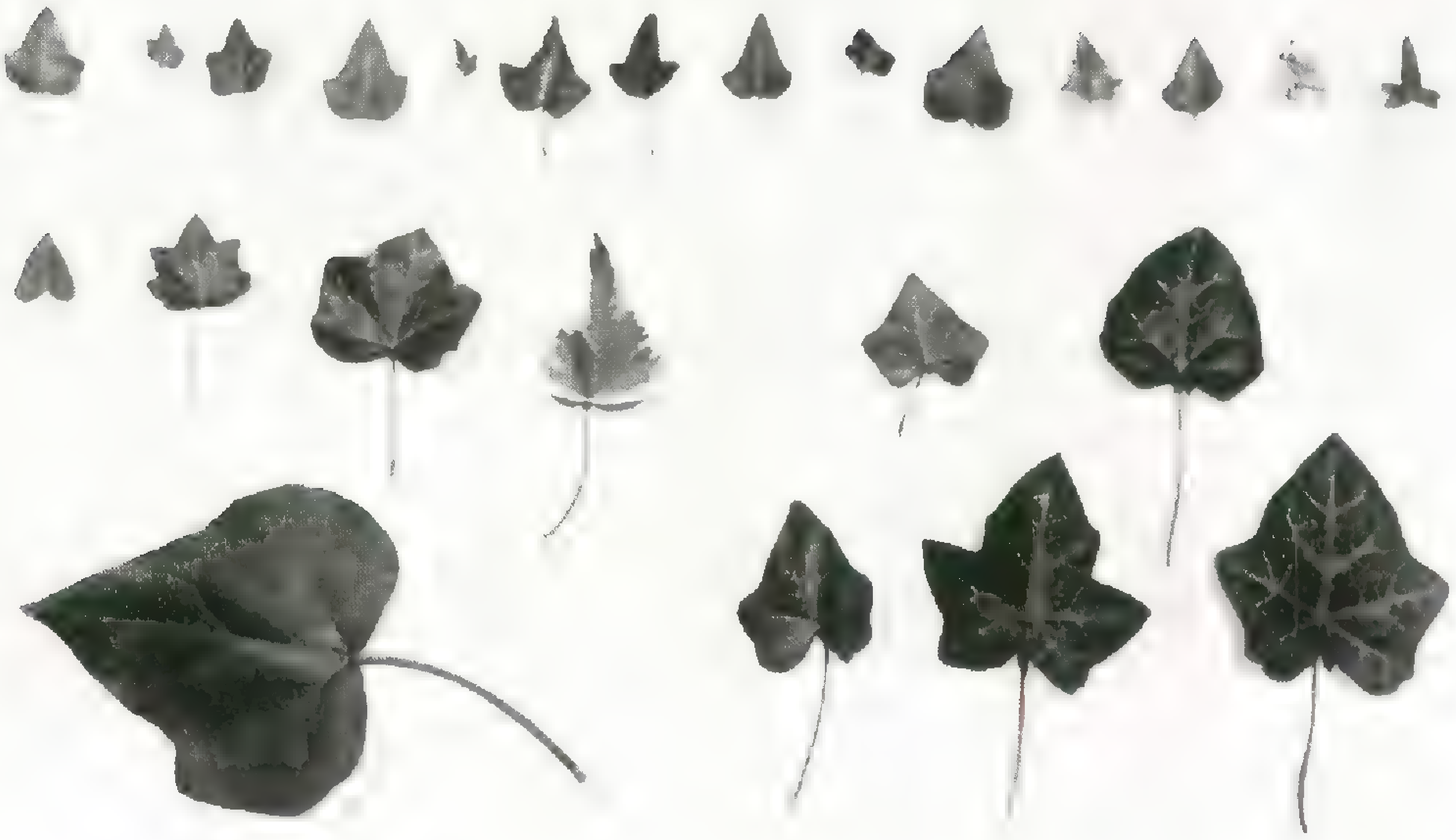
In recent years many house plants have been raised successfully in *Wardian Cases or Terrariums.* These glass bottles, fish bowls, aquariums, and miniature greenhouses (pl. 52) provide a favorable moist atmosphere for a lot of temperamental plants that would not survive if exposed to the dry air found in most homes. Good results, however, depend on a knowledge of the moisture requirements of the plants used. It is disastrous to keep cacti and succulents in a glass case that is super-saturated with water. In fact, very few plants will tolerate such a condition. A single watering may last weeks, months, or even a year, if the case has a tight-fitting lid. Always keep the soil on the "dry side" and raise the lid occasionally to let in fresh air. When exposed to direct sunlight, the lids should be removed entirely as these glass cases heat up rapidly.

Another type of Wardian Case that has many advantages over glass, is made with Lumarith (see pl. 51), a new light-weight, transparent, plastic material similar to cellophane, only much thicker and far more durable. The framework of this case is made of wood and strips of thick plastic are nailed on the outer edges of the frame. Sheets of Lumarith are then cemented to these strips with acetone, forming the sides and lid (hinged). If part of the front side is also hinged, it is much easier to service the plants. The bottom can be made of wood or metal as may be desired, leaving a small opening to drain off any accumulation of water. An inch layer of gravel on the bottom makes a good base on which to set the plants. If you are raising Orchids, a wooden rack covered with wire netting should be substituted for the gravel to insure better air circulation. Yes, certain kinds of Orchids make good house plants, if you keep them in a case of this type where they have constant moisture, "no draft ventila-



Dwarf ornamental pomegranate has attractive orange-red flowers and fruits.

Chlorophytum "Goldianum" (Spider Plant). An improved horticultural form.



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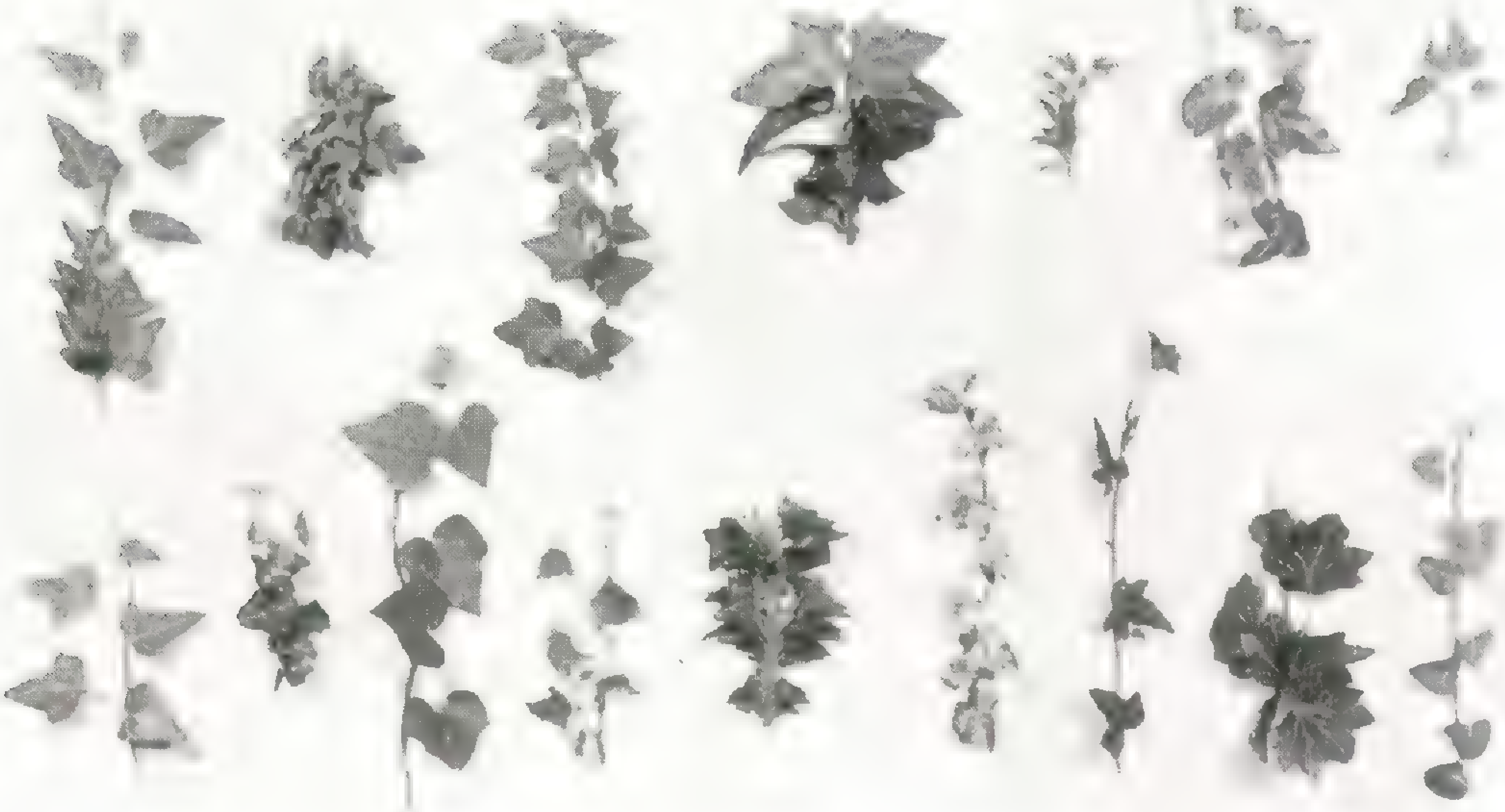

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tion," a moderate amount of direct sunlight and a temperature around 70° F. However, experience will soon show that growing Orchids to perfection at home is no "cinch" regardless of the inspirational articles that have appeared recently in garden magazines.

Hydroponics, or growing plants in nutrient solutions without the use of soil, has created a tidal wave of enthusiasm in amateur circles. Of course, it really is a very interesting subject and I have no intention of underestimating its potential value, but, unfortunately, many garden-minded people have been led astray by glowing accounts and impressive photographs of extraordinary tomato crops. They have found out the hard way that these photographs are extremely difficult to duplicate in their own back yards. To avoid disappointments amateurs should not stumble too hopefully into this hydroponics business. Growing plants in nutrient solutions is no new idea; investigators have been thrashing around with it for years. Many rough spots still remain to be ironed out, and it will be a long, long time (if ever) before all our gardening is done in water instead of soil. While you are waiting for this to happen, try raising Philodendron, Ivy, Scindapsus, Chinese Evergreen and Umbrella Plant (Cyperus) in water cultures. Add a pinch of any complete fertilizer (one containing Nitrogen, Phosphorous and Potassium), then you can say you are experimenting with hydroponics. Visitors may be impressed.

PLATE 55

1. TYPICAL LEAVES OF VARIOUS KINDS OF IVIES

Top row: Hahn's Self-branching, Hahn's Miniature, Maple Queen, Sylvanian Beauty, Green Feather, Green Quartz, Long Point, Pittsburgh, *Hedera Helix* var. *gracilis* (?), Richmond Gem, *H. Helix* var. *discolor* (?), var. *conglomerata*, var. *Howardii* (?), var. *pedata* (?).

Center row: *Hedera Helix* var. *rhomboidea*, var. *digitata*, *H. Helix* (true form of English Ivy), Gloire de Marengo, var. *baltica* (very hardy), var. *baltica* "Comarno" (a selected strain of Baltic ivy).

Bottom row: *Hedera colchica*, and three selected strains of Baltic Ivy *(H. Helix* var. *baltica)*—Gabrovo, Rila and Vitosha.

2. TYPICAL BRANCHES OF VARIOUS KINDS OF IVIES

Top row: Hahn's Self-branching, Hahn's Miniature, Maple Queen, Sylvanian Beauty, Green Feather, Green Quartz, Long Point.

Bottom row: Pittsburgh, *Hedera Helix* var. *gracilis* (?), Richmond Gem, *H. Helix* var. *discolor*, var. *conglomerata*, var. *Howardii*, var. *pedata*, var. *digitata*, var. *rhomboidea*.

Propagation.—From time to time house plants have to be renewed, either by purchasing fresh specimens or by growing them from seeds and cuttings (slips). There is nothing quite like raising your own, when you know how. Beginners will find it takes practice and patience. Detailed information on the subject will be found in the April, 1941, issue of the Garden BULLETIN. Here in brief are some of the main considerations:

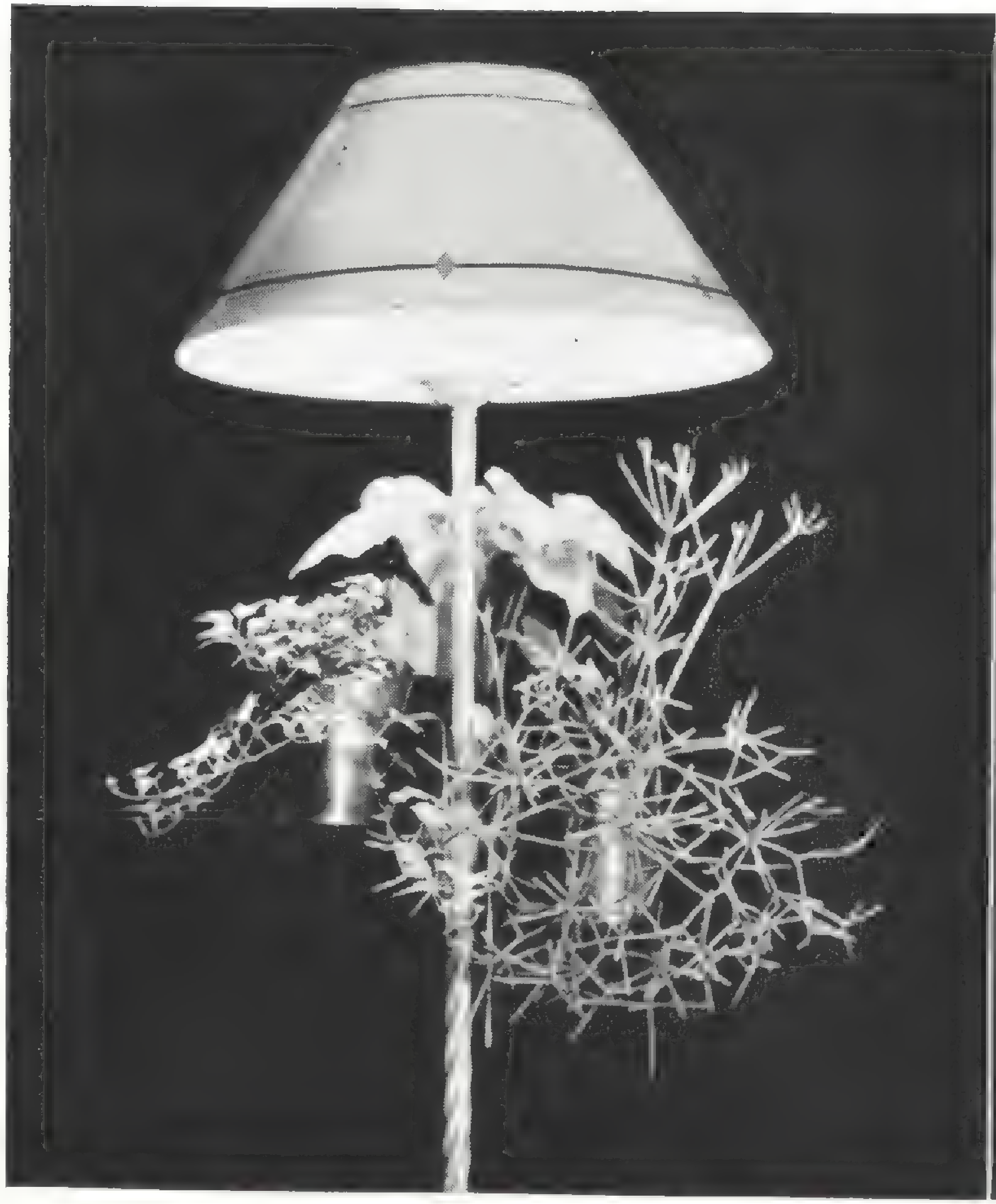
SEEDS

1. Use a porous loam soil containing no strong fertilizers.
2. Sterilize the soil thoroughly with steam, boiling water or some other heat treatment to prevent "damping off" disease which ruins seedlings. It is claimed a thin layer of sphagnum moss on top of the soil also discourages "damping off."
3. After the seed is sown, the soil must be kept just moist, not soaking wet or bone-dry.
4. Temperature around 65°–75° F.
5. Seed-pots should be shaded until the seedlings appear above the soil, then full sunlight is necessary.
6. Good air circulation and a fairly moist atmosphere are important.
7. A cool sun-porch or conservatory is ideal for raising plants from seed.

CUTTINGS

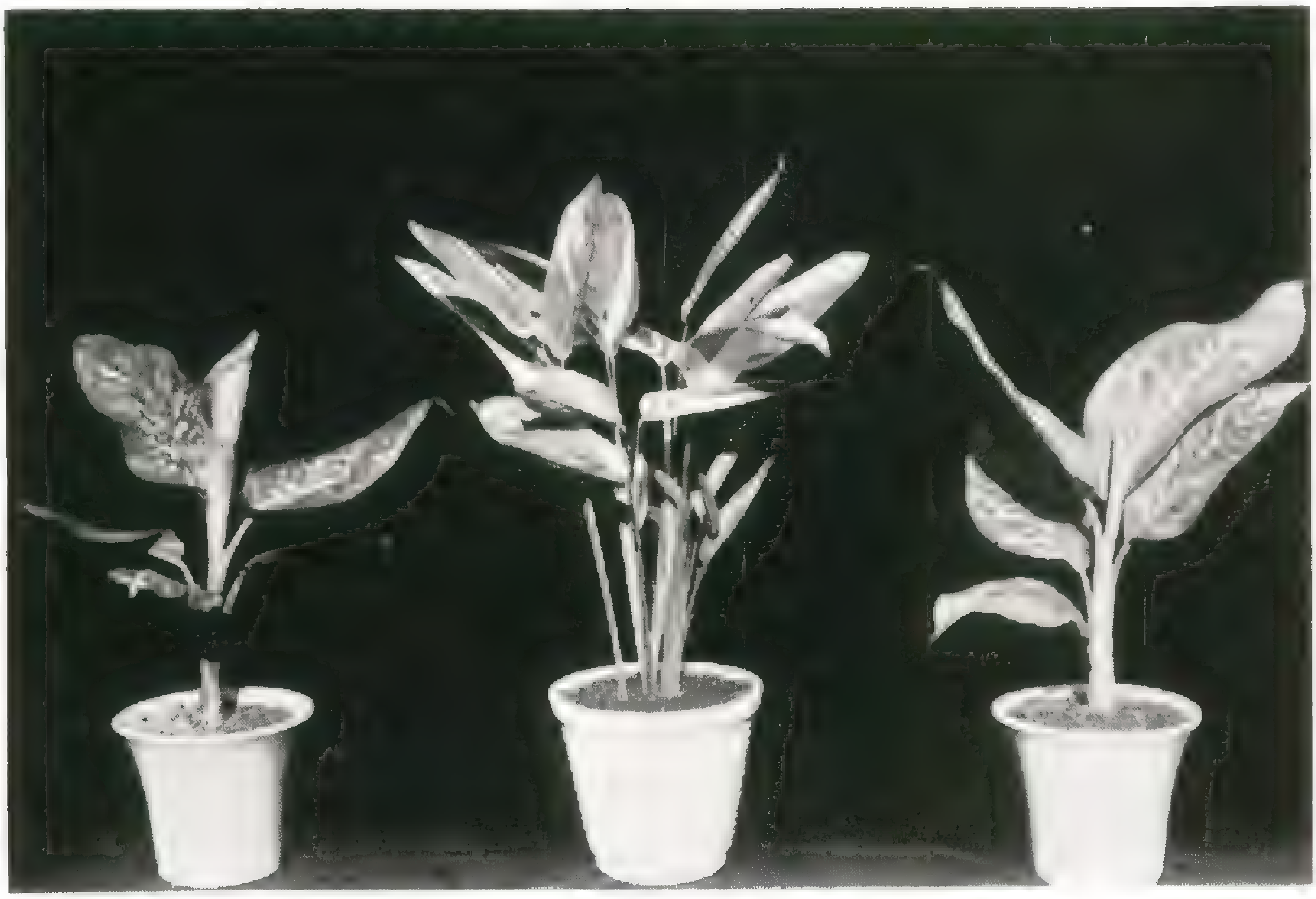
1. All plants are not propagated by stem cuttings or "slips." Some are increased by offsets, layers, tuberous roots, leaf cuttings, etc.
2. Cuttings of all kinds are best made from strong, healthy plants.
3. A mixture of half sand-half peat is a good rooting medium.
4. Keep the cuttings moist but not saturated with water. A glass jar placed over them will help retain the moisture and prevent wilting.
5. Shade the cuttings for the first few days, then gradually bring them into full sunlight.
6. A temperature of about 70° F. is favorable for rooting which in most cases will occur in 2–4 weeks.
7. When the cuttings are well rooted, pot them up in fertile soil.

Summer Care of House Plants.—Move them outdoors to the porch, terrace, or into a sheltered part of the garden where they will have the benefit of fresh air, rain and a moderate amount of sunlight. Some may need repotting in new soil to encourage active growth. As fall approaches, cuttings can be rooted and the old plants discarded if they are too large to bring back into the house. Geraniums, Begonias, Fuchsias, Ivies and other plants that have been growing well all summer should be repotted in fertile soil and brought indoors before frost. Vigorous specimens may need pruning to a desirable size and shape. Do not be alarmed if a few

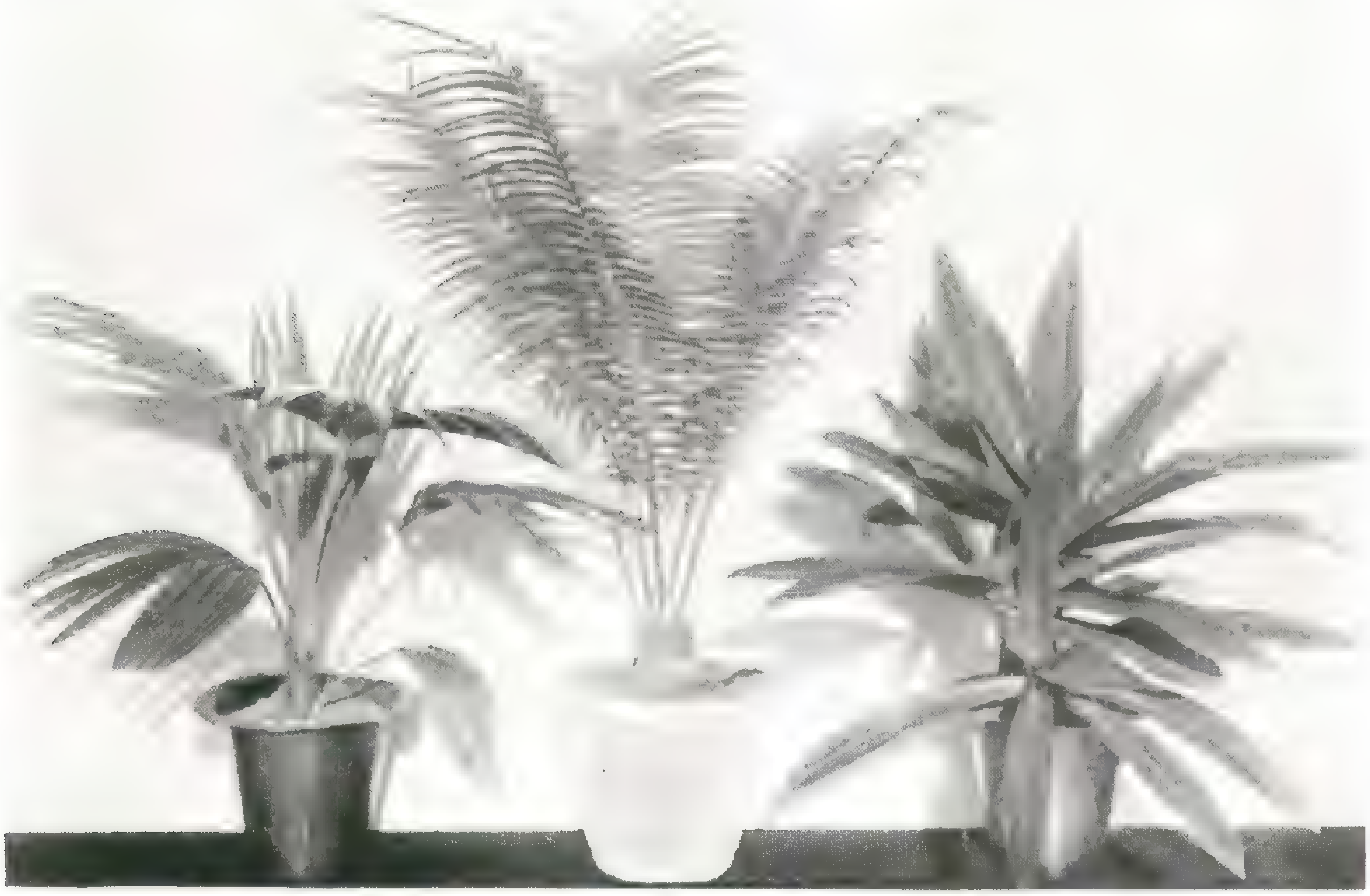


Floor lamp with attachments to suspend plants under the light.

Aglaonema simplex (Chinese Evergreen).



Dieffenbachia picta, Calathea variegata, Dieffenbachia Bowmannii.



Livistonia cochinchinensis *Rhoeo discolor*
Microcycas calocoma

leaves drop off. It takes a week or two for the plants to get acclimated to the change of atmosphere. Some never do.

Effective Arrangement.—To display plants to best advantage, give them appropriate settings, just as you would do for etchings, furniture, rugs or any other feature of interest around the house. This means we must consider such items as color, texture, design, lighting, the use of mirrors, etc. It is surprising what different effects can be obtained simply by changing the color of background, say, from gray to blue. Anyone who is not color-blind can soon determine what combinations are most striking. Lighting, of course, is of particular value at night, and it may be necessary to move the plants from a window-sill to a table where they make a better showing. Always select plants that harmonize with the texture, design and general atmosphere of the room in which they are to be used. Certain specimens are rugged; some are rather delicate and refined; some have modernistic lines. Plants, as well as flower bouquets, can be made to do double duty if placed where they are properly reflected in a mirror. Another way to display plants effectively is to arrange them in groups instead of using them as single specimens. When mixing various kinds together, be sure to maintain a well-balanced or symmetrical arrangement.

Making special collections of Begonias, Ivies, Scented Geraniums, Cacti, Coleus, etc., also adds a great deal of zest to indoor gardening. This collecting "bug" is usually the final stage.

SELECT LISTS OF HOUSE PLANTS

Naturally, personal likes and dislikes will always be a deciding factor in choosing plants for the home. Other considerations are environment, type of room and the amount of time a person is willing to spend taking care of them. The latter item is often very decisive. Some plants require almost constant attention, whereas others are more self-reliant and capable of living successfully with high-strung individuals who seldom come home to roost. As previously mentioned, house plants are best segregated into several groups to make it easier for beginners to select the right kinds. Of course, these groups overlap considerably, so the same names may appear in different lists.

1. Florists' Plants.—Certain plants are very difficult, if not impossible, to raise satisfactorily in the home. They should be purchased as mature specimens in full bloom. Their period of usefulness is limited to a few weeks, after which replacements are necessary to maintain a good display. The flowering period can be extended if the plants are kept in a cool room, but they are not worth saving for another year.

Begonia (Melior, Cincinnati, Lady Mac, Marjorie Gibbs, and other "semi-tuberous" types)
Calceolaria (Lady's Pocketbook)
Calendula (Pot Marigold)
Christmas Pepper (red fruit)
Cineraria
Cyclamen
Geranium (Martha Washington type)
Jerusalem Cherry (red berries)
Marguerite Daisy
Primrose (*obconica* and *malacoides* types)
Schizanthus (Poor Man's Orchid)

2. Flowering House Plants.—All the kinds listed in this group require an abundance of direct sunlight to grow well and produce flowers. African Violets are not so particular, but even they flourish better if exposed to morning sun for a few hours.

Fall blooming

Abutilon (Flowering Maple)
Begonia semperflorens (Everblooming Begonia)—many kinds; also numerous other species
Beloperone (Shrimp Plant)
Chrysanthemum (bush type—many kinds) (pl. 53)
Cuphea (Cigar Flower)
Impatiens (Touch-me-not)
Pelargonium hortorum (Common Geranium)—many kinds
Pelargonium peltatum (Ivy Geranium)—several kinds
Punica (Ornamental Pomegranate)—scarlet fruit (pl. 54)
Saintpaulia (African Violet)—several kinds

Winter blooming

Calceolaria
Capsicum (Christmas Pepper)
Cyclamen
Eucharis grandiflora (Amazon Lily)
Euphorbia fulgens (Scarlet Plume)
Euphorbia pulcherrima (Poinsettia)
Fuchsia (Lady's Ear-drops)—several kinds
Lantana montevidensis (Weeping Lantana)
Moraea (Winter Iris)
Neomarica (Apostle Plant)
Pelargonium odoratissimum (Nutmeg Geranium)
Primula obconica (Common Primrose)

Davallia decurrens (Leather Fern), one of the best ferns for home use.

Philodendron Meliononi. Unusual.

Geranium and Pandanus window arrangement.

Pandanus Veitchii (Screw-pine) makes a large specimen plant.

Primula malacoides (Fairy Primrose)
Senecio cruentus (Cineraria)
Solanum Pseudo-Capsicum (Jerusalem Cherry)—scarlet fruit

Spring blooming

Astilbe (Japanese Astilbe)—get mature, flowering plants at the florist shop
Chrysanthemum frutescens (Marguerite Daisy)
Dicentra spectabilis (Bleeding Heart)—buy dormant clumps in spring and force into flower
Euphorbia splendens (Crown of Thorns)
Exacum affine (Exacum)
Hydrangea—get mature, flowering plants at the florist shop
Pelargonium domesticum (Martha Washington Geranium)
Plumbago capensis (Leadwort)
Rhododendron indicum (Azalea)—many kinds
Viola tricolor (Pansy)—winter plants in cold-frame and bring indoors when they start to bloom

Summer blooming

Lagerstroemia indica (Crepe Myrtle)
Nerium Oleander (Oleander)—store plant in basement over winter

Many of the plants mentioned in Group 2 flower intermittently throughout the entire year, but to save space we have listed them only once.

3. Foliage House Plants.—This group of plants is valued particularly for attractive leaves, flowers being rather incidental. They tolerate unfavorable growing conditions and are especially valuable in homes where the amount of sunlight is so limited that most of the flowering plants listed in Group 2 could not be raised successfully.

Aglaonema simplex (Chinese Evergreen)— may be grown in water (pl. 56)
Aglaonema Robelinii—variegated form with leaves marked pale green
Araucaria excelsa (Norfolk Island Pine)
Aspidistra elatior (Cast-iron Plant)
Aspidistra elatior var. *variegata*—leaves striped white
Begonia Rex-cultorum (Rex Begonia)—many other kinds of foliage Begonias can be used
Chlorophytum elatum (Spider Plant)
Chlorophytum variegatum—leaves striped white
Codiaeum variegatum var. *pictum* (Croton)—many kinds
Coleus Blumei (Coleus)—many kinds
Cordyline indivisa (Fountain Plant)
Cordyline terminalis—several forms with different leaves
Cycas revoluta (Sago Palm) and *Microcycas calocoma* (pl. 57)
Cyperus alternifolius (Umbrella Plant)
Dieffenbachia picta (Dumb Cane)—several other kinds (pl. 57)

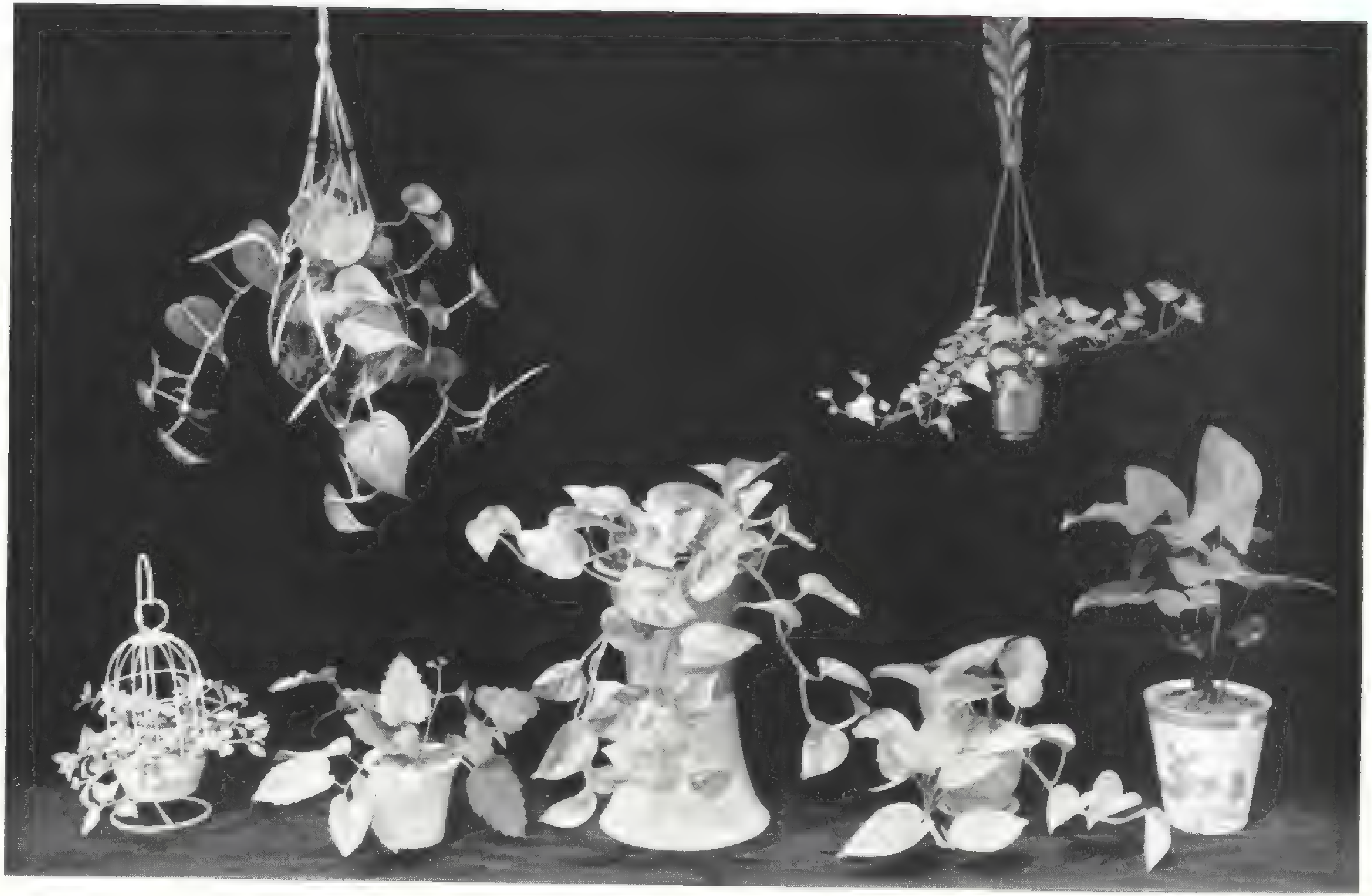
Dracaena deremensis—leaves penciled white
Dracaena fragrans (Corn Plant)
Dracaena fragrans var. *Massangeana*—leaves striped yellow
Dracaena Godseffiana—leaves spotted white

Ferns:
  Asparagus plumosus (Asparagus Fern)
  Asparagus Sprengeri (Sprengeri Fern)
  Cyrtomium falcatum (Holly Fern)
  Davallia decurrens (Leather Fern) (pl. 58)
  Nephrolepis exaltata var. *bostoniensis* (Boston Fern)
Ficus elastica (Rubber Plant)
Ficus elastica var. *variegata*—leaves variegated cream to white
Ficus lyrata (Fiddle-leaf Rubber Plant)
Grevillea robusta (Silk Oak)
Ligularia Kaempferi var. *aureo-maculata* (Leopard Plant)
Ophiopogon japonicus (Dwarf Lily-Turf)

Palms:
  Chrysalidocarpus lutescens (Golden Palm)
  Howea Belmoreana and *H. Forsteriana* (Thatch Palms)
  Livistona chinensis (Chinese Fan Palm)
  Syagrus Weddelliana (Dwarf Coconut Palm)
Pandanus Veitchii (Screw-pine—pl. 59)—*P. Baptistii* is a spineless form.
Persea americana (Avocado)—start plants from "pears" suspended in water
Pilea microphylla (Artillery Plant)—two kinds
Rhoeo discolor (Baby-in-the-Cradle) (pl. 57)
Saxifraga sarmentosa (Strawberry Geranium)

4. Trailing and Climbing Plants.—In the early stages of development certain trailing plants assume an upright position, but if allowed to grow normally they eventually become vine-like in habit. Some have tendrils which enable them to climb, others have to be assisted. Most of these plants look well in hanging baskets, wall-brackets, etc. They grow far better if exposed to direct sunlight during winter.

Asparagus Sprengeri (Asparagus Fern)
Ceropegia Woodii (Rosary Vine)
Chlorophytum variegatum (Spider Plant)
Cissus rhombifolia (Grape Ivy)
Coleus "Trailing Queen"
Cymbalaria muralis (Kenilworth Ivy)
Euonymus Fortunei var. *radicans* (Creeping Euonymus)—several other kinds
Ficus pumila (Creeping Fig)
Fuchsia procumbens (Trailing Fuchsia)
Hedera Helix (English Ivy)—many horticultural varieties available (pl. 55).
Ipomoea Batatas (Sweet Potato)—sprout potato by suspending in water



TRAILING PLANTS

Top: Philodendron, Hahn's Self-branching Ivy.

Bottom: Aptenia (Ice Plant), *Cissus antarctica*, *Scindapsus aureus* var. *Wilcoxii*, *S. aureus* var. Silver Queen, Nephthytis.

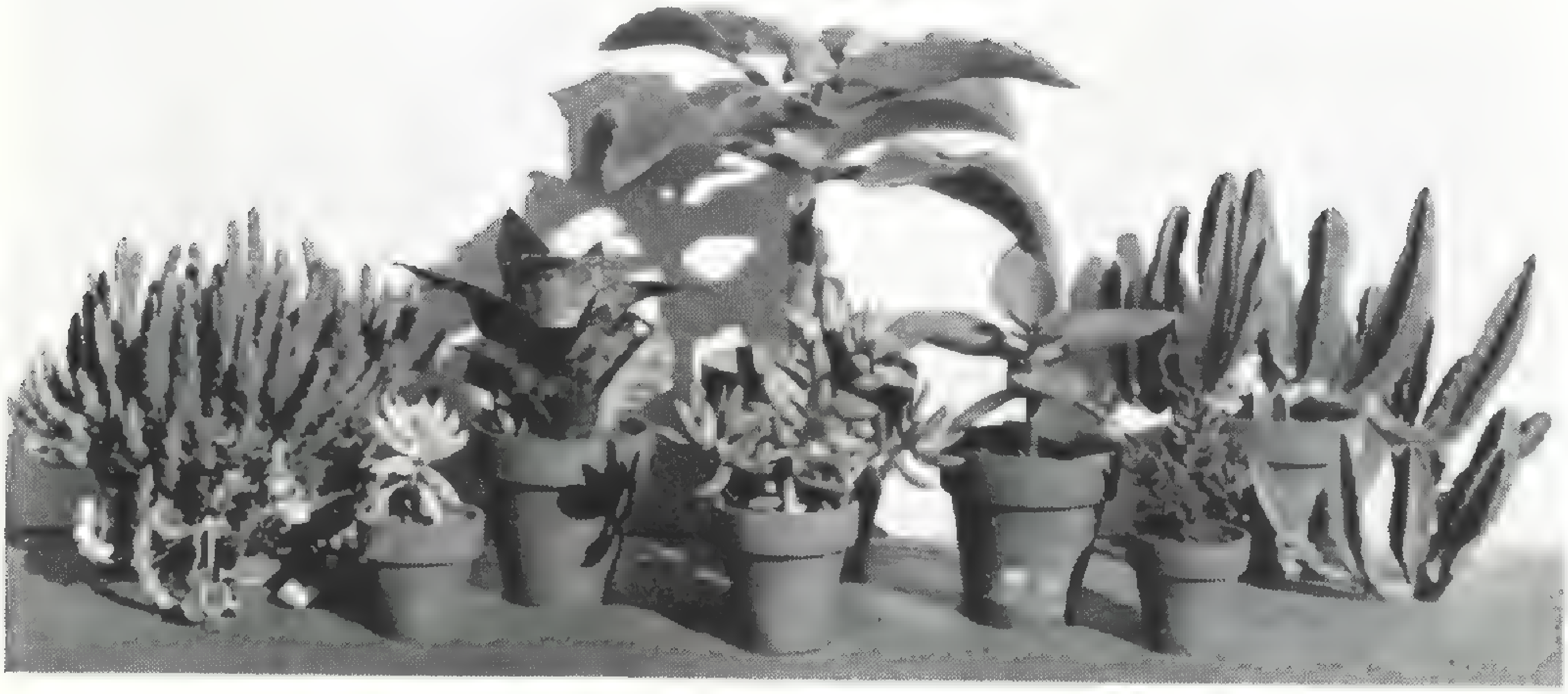
Lantana montevidensis (Trailing Lantana)
Lysimachia Nummularia (Creeping Jennie)
Muehlenbeckia complexa (Wire Vine)
Nephrolepis exaltata var. *bostoniensis* (Boston Fern)
Nephthytis Afzelii (Nephthytis) (pl. 60)
Oplismenus compositus var. *vittatus* (Variegated Basket Grass)
Oxalis Bowieana (Oxalis)—many other kinds, but this one is the best; needs a sunny location (pl. 53)
Philodendron cordatum (Philodendron) (pl. 60)
Scindapsus aureus (Ivy Arum)—also known as *Pothos aureus* or Variegated Philodendron
Scindapsus aureus var. *Wilcoxii*—leaf variegations more attractive than those of *S. aureus* (pl. 60)
Senecio mikanioides (German Ivy)
Stenotaphrum secundatum var. *variegatum* (St. Augustine Grass)
Thunbergia alata (Black-eyed Susan)—needs a sunny location
Tradescantia fluminensis (Wandering Jew)—plain green and variegated forms
Vinca major var. *variegata* (Trailing Periwinkle)
Zebrina pendula (Purple Wandering Jew)

5. Cacti and Other Succulents.—Without doubt this is the most satisfactory group of plants for extremely difficult places where the atmosphere is constantly hot and dry. They like sun but will struggle along fairly well in part shade. The majority of these plants grow very slowly, so frequent repotting is unnecessary or even harmful. Over-watering and fertilizers should be avoided, especially during winter when the plants are semi-dormant. There is such a wide assortment of cacti and succulents which might be used as house plants that it is impossible to prepare a representative list without overlooking many worthy subjects. Here are just a few, listed according to families in order to show the relationships which exist between these odd specimens.

AMARYLLIS FAMILY *(Amaryllidaceae)*
- *Agave americana* var. *marginata* (Variegated Century Plant)
- *Agave parviflora* (Dwarf Century Plant)
- *Agave Toumeyana* (pl. 61)

FIG MARIGOLD FAMILY *(Aizoaceae)*
- *Aptenia cordifolia* (Ice Plant) (pl. 60)
- *Faucaria tigrina* (Tiger's Jaw)
- *Hereroa granulata* (Hereroa)
- *Lampranthus roseus* (Rose Fig Marigold)
- *Lithops kunjasensis* (Living Stones)
- *Oscularia deltoides* (Oscularia)

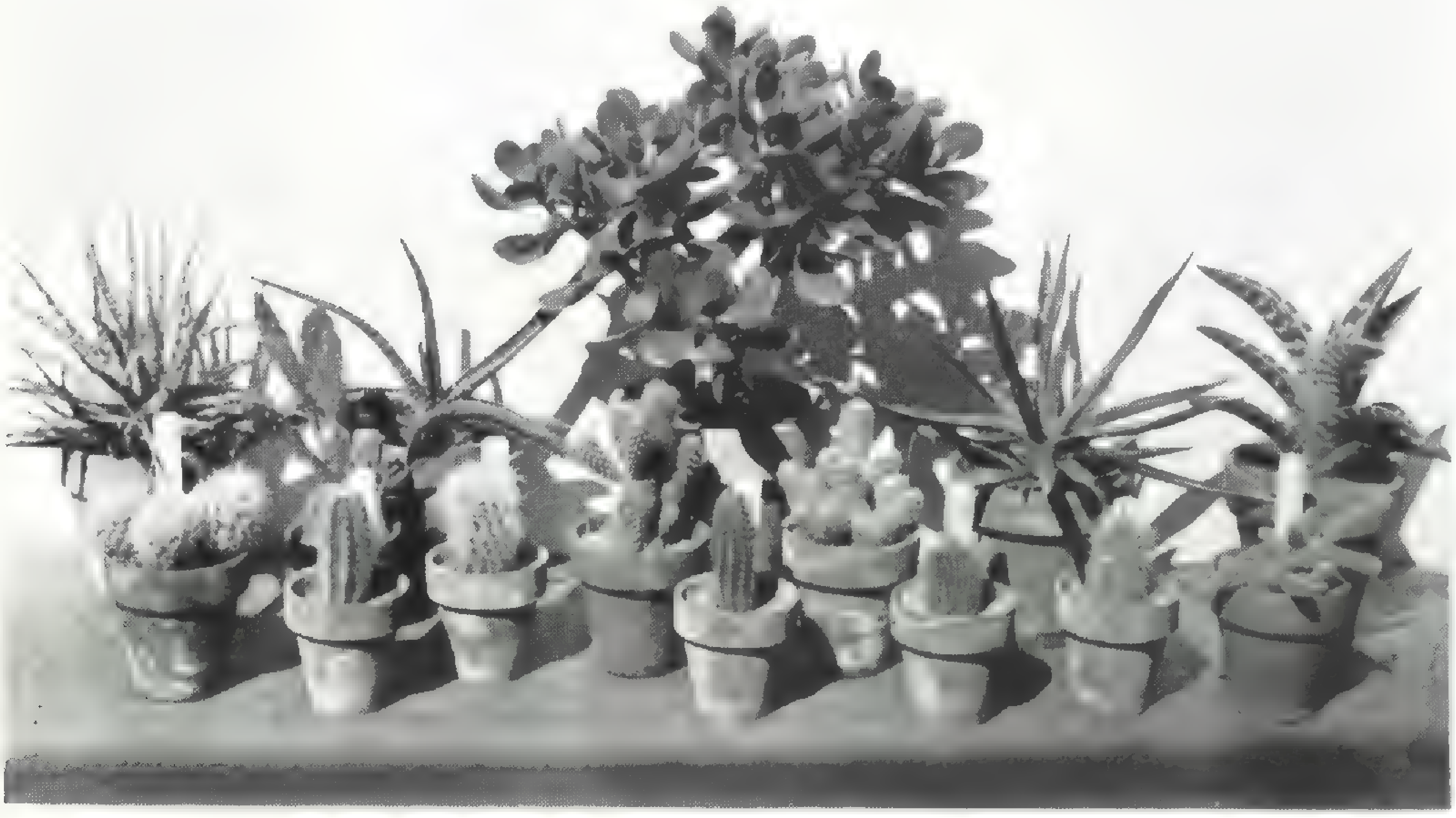
MILKWEED FAMILY *(Asclepiadaceae)*
- *Echidnopsis cereiformis* (Corn-cob Cactus)
- *Hoya carnosa* (Wax Plant)
- *Huernia macrocarpa* var. *Penzigii* (King of the Dragons)



COLLECTION OF SUCCULENT PLANTS

Back row: *Stapelia variegata, Kalanchoë beharensis, Stapelia gigantea.*

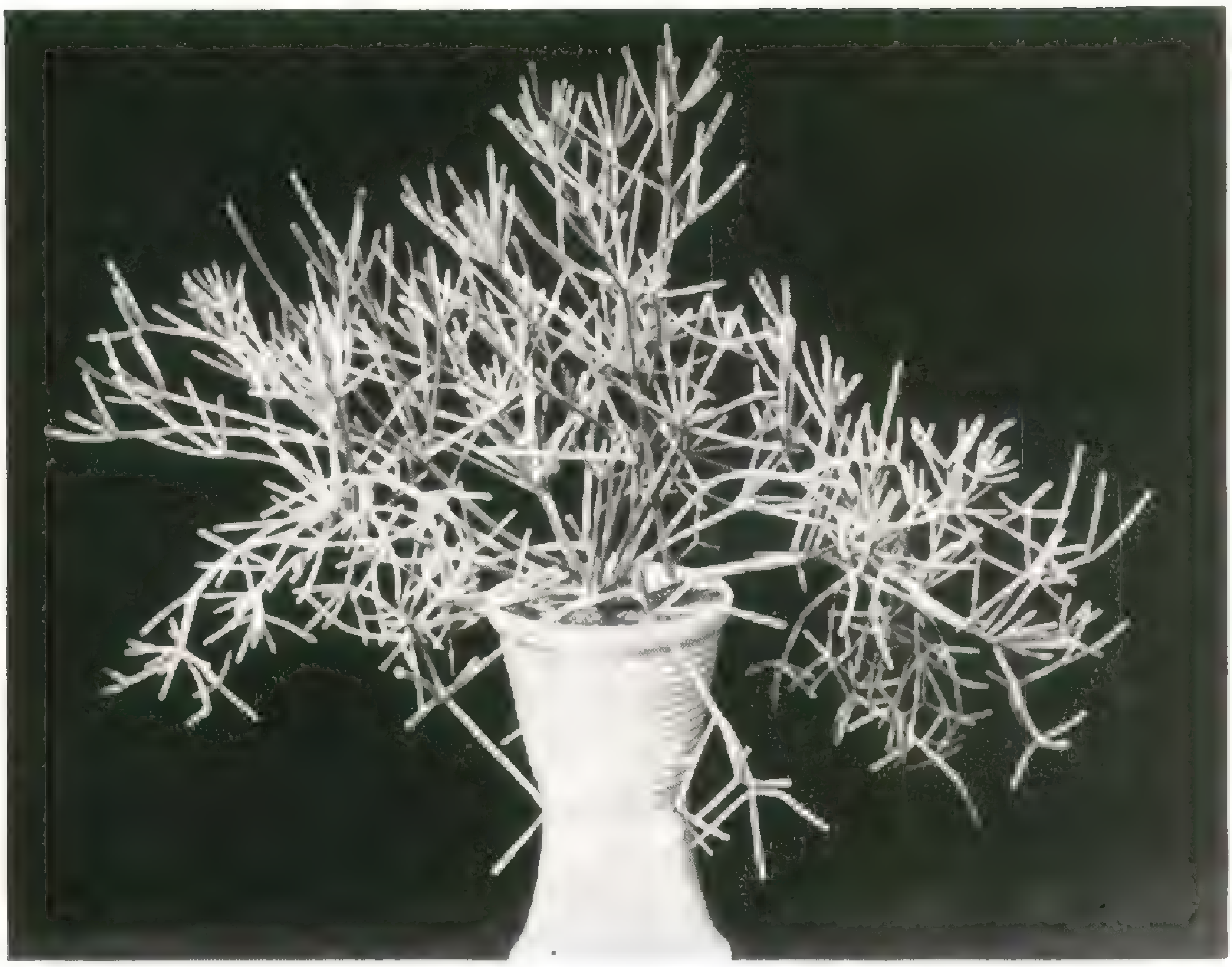
Front row: *Kleinia tomentosa, Sansevieria Hahnii, Sedum Adolphii, Kalanchoë orgyalis, Sedum guatemalense.*



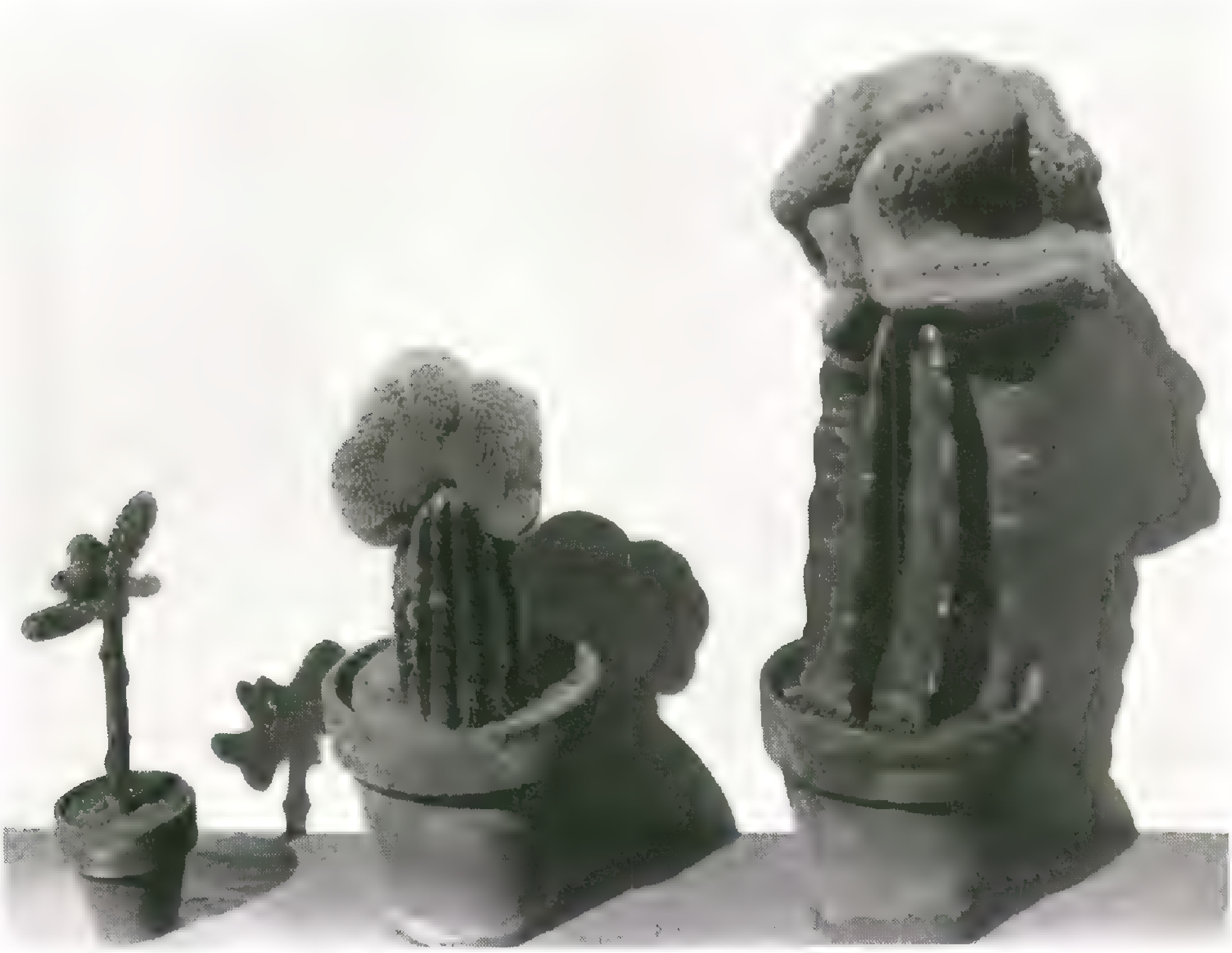
COLLECTION OF CACTI AND SUCCULENTS

Back row: *Aloe humilis, Gasteria trigona, Crassula argentea, Agave Toumeyana, Aloe variegata.*

Front row: *Escobaria dasyacantha, Opuntia maldonadensis, Escontria Chiotilla, Cephalocereus senilis, Opuntia mammillata cristata, Trichocereus Spachianus, Mammillaria elongata, Notocactus Leninghausii, Cephalocereus Hoppenstedtii, Chamaecereus Silvestri.*



Rhipsalis cassutha (Mistletoe Cactus), a very dependable house plant.



Grafted Cacti. Note Washington's silhouette in shadow formed by plant at right.

Stapelia variegata (Carrion Flower) (pl. 61)
Stapelia gigantea (Giant Carrion Flower) (pl. 61)

CACTUS FAMILY *(Cactaceae)*
Cephalocereus senilis (Old Man Cactus) (pl. 61)
Cereus pernambucensis monstrosus (Torch Cactus)
Chamaecereus Silvestri (Peanut Cactus) (pl. 61)
Echinocactus Grusonii (Golden Ball Cactus)
Mammillaria candida (Pincushion Cactus)
Opuntia microdasys (Bunny Ears)
Rhipsalis cassutha (Mistletoe Cactus) (pl. 62)
Zygocactus truncatus (Christmas Cactus)

ORPINE FAMILY *(Crassulaceae)*
Aeonium arboreum (Hen and Chickens)—one of several kinds
Bryophyllum crenatum (Chandelier Plant)—several different kinds
Byrnesia Weinbergii (Ghost Plant)
Crassula argentea (Chinese Jade Plant) (pl. 61)
Crassula Lycopodioides (Princess Pine)
Kalanchoë Blossfeldiana (Kalanchoe)—a free-flowering type
Kalanchoë beharensis (Mohair Kalanchoe) (pl. 61)
Sedum Adolphii (Stonecrop) (pl. 61)
Sedum guatemalense (Stonecrop)—many other different kinds (pl. 61)

LILY FAMILY *(Liliaceae)*
Aloe variegata (Variegated Aloe)—many other species (pl. 61)
Schizobasopis volubilis (African Onion)
Gasteria nigricans (Hart's Tongue)—several other kinds
Haworthia arachnoides (Haworthia)—many other kinds
Sansevieria trifasciata (Mother-in-law's Tongue)
Sansevieria trifasciata var. *Laurenti*—leaves variegated yellow

PEPPER FAMILY *(Piperaceae)*
Peperomia obtusifolia (Pepper Elder)
Peperomia Sandersii var. *argyreia* (Watermelon Begonia)

6. *New or Unusual Plants.*—

Acalypha hispida (Chenille Plant)—drooping, red flower spikes resembling a cat's tail
Aechmaea Weilbachii (Aechmaea) (pl. 63)
Billbergia pyramidalis (Torch Plant)—dense red flower spike resembling a torch (pl. 63)
Chlorophytum "Goldianum" (Spider Plant)—an improved horticultural form (pl. 54)
Cissus antarctica (Cissus)—a large-leaved, vigorous-growing type (pl. 60)
Cissus striata (Dwarf Grape Ivy)—miniature form of Cissus
Gynura aurantiaca (Velvet Plant)—leaves velvety and covered with bright purple hairs; orange flowers produced in spring
Kalanchoë orgyalis (pl. 61)
Kalanchoë tomentosa (Woolly Kalanchoë)—thick, gray, woolly leaves tipped brown; colorful
Kleinia ficoides
Kleinia tomentosa (pl. 61)

Lopezia coronata (Mosquito Plant)—interesting flowers; not too easy to grow
Malpighia coccigera (Malpighia)—looks like a miniature form of American Holly
Mimosa pudica (Sensitive Plant)—leaves fold up when touched
Pelargonium echinatum (Desert Geranium)—dormant during summer, flowers freely in winter
Peperomia obtusifolia var. *variegata* (Variegated Pepper Elder)
Peperomia pulchella (Dwarf Peperomia)
Philodendron dubium (pl. 64)
Philodendron erubescens (pl. 64)
Philodendron Meliononi (pl. 58)
Sansevieria cylindrica—round-leaved form of Mother-in-law's Tongue
Sansevieria Hahnii—a new dwarf, rosette form of Sansevieria (pl. 61)
Sansevieria parva—a new dwarf type with narrow leaves
Scindapsus aureus var. "Silver Queen"—a new variety similar to *S. aureus* var. *Wilcoxii*, but leaves variegated with white (pl. 60)
Tolmiea Menziesii (Mother of Thousands)—small plantlets produced on the mature leaves

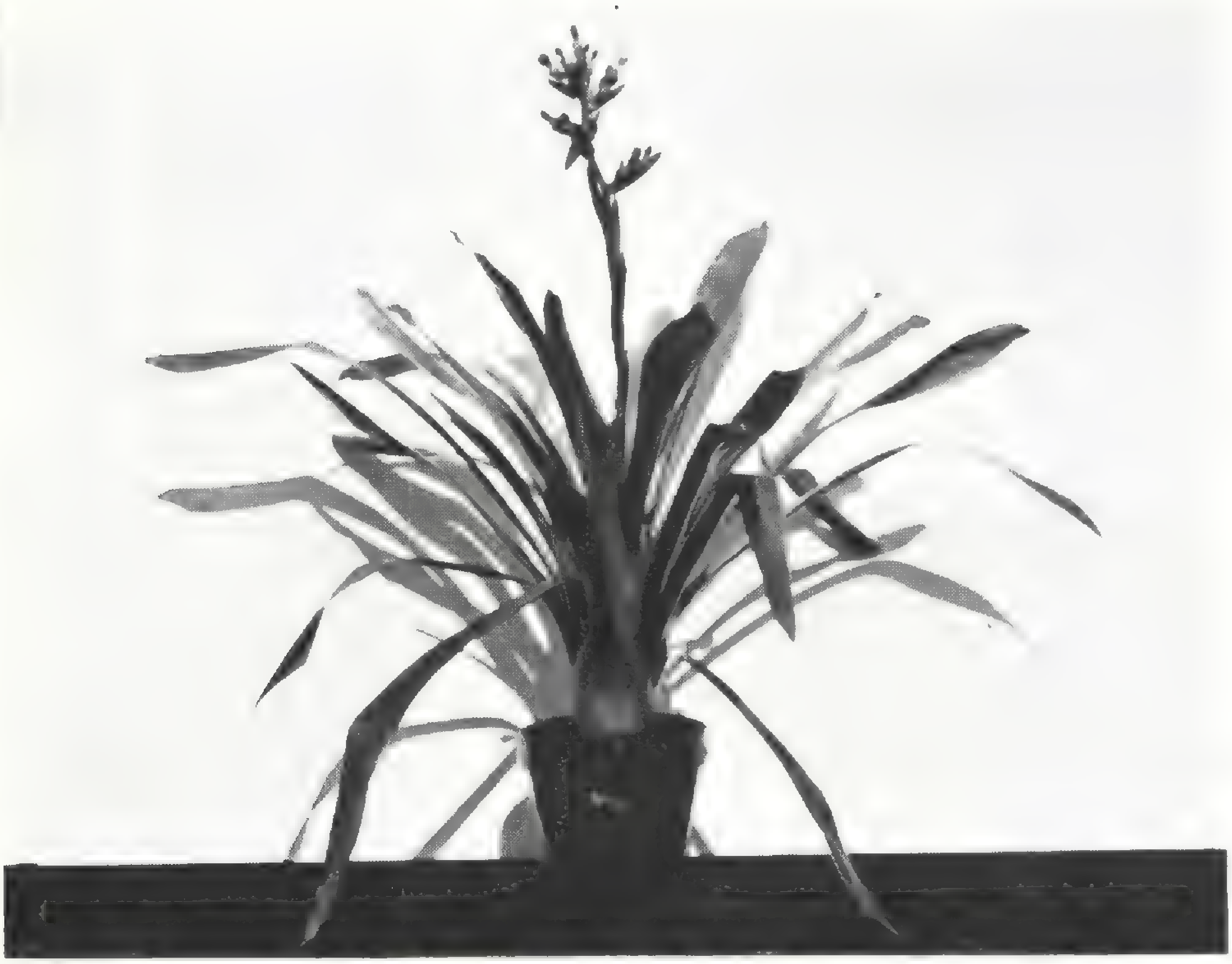
7. *Extremely Dependable House Plants.*—From the foregoing lists the following plants have been selected in recognition of their outstanding ability to succeed where all others fail. Especially recommended for dark, super-heated apartments in the city. If these refuse to grow, the case is hopeless.

Agave (Century Plant)—several kinds
Aloe—several kinds
Aglaonema (Chinese Evergreen)
Aspidistra (Cast-iron Plant)
Bryophyllum (Chandelier Plant)—several kinds
Cacti—many kinds
Cissus (Grape Ivy)
Crassula (Chinese Jade Plant)
Cyperus (Umbrella Plant)
Dieffenbachia (Dumb Cane)—several kinds
Dracaena (Corn Plant)
Ficus (Rubber Plant)—several kinds
Gasteria (Hart's Tongue)
Grevillea (Silk Oak)
Hedera (English Ivy)—several horticultural varieties
Howea (Dwarf Palm)
Hoya (Wax Plant)
Nephthytis
Pandanus (Screw-pine)
Philodendron—several kinds
Rhipsalis (Mistletoe Cactus)
Sansevieria (Mother-in-law's Tongue)—several kinds
Sedum (Stonecrop) — several kinds
Stapelia (Carrion Flower)—several kinds

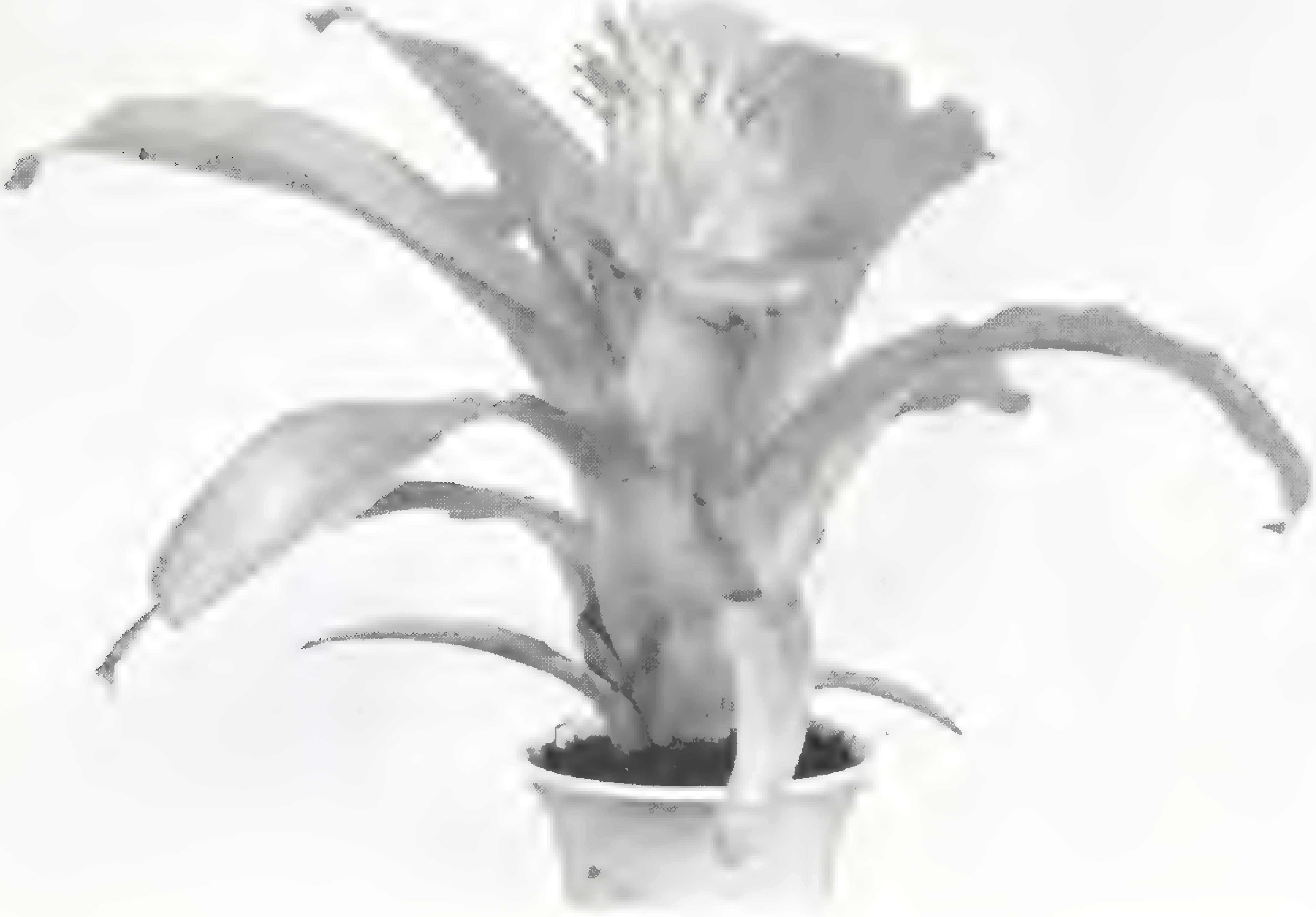
8. *Plants for Indoor Window-boxes and Ferneries.*—

SUNNY EXPOSURE

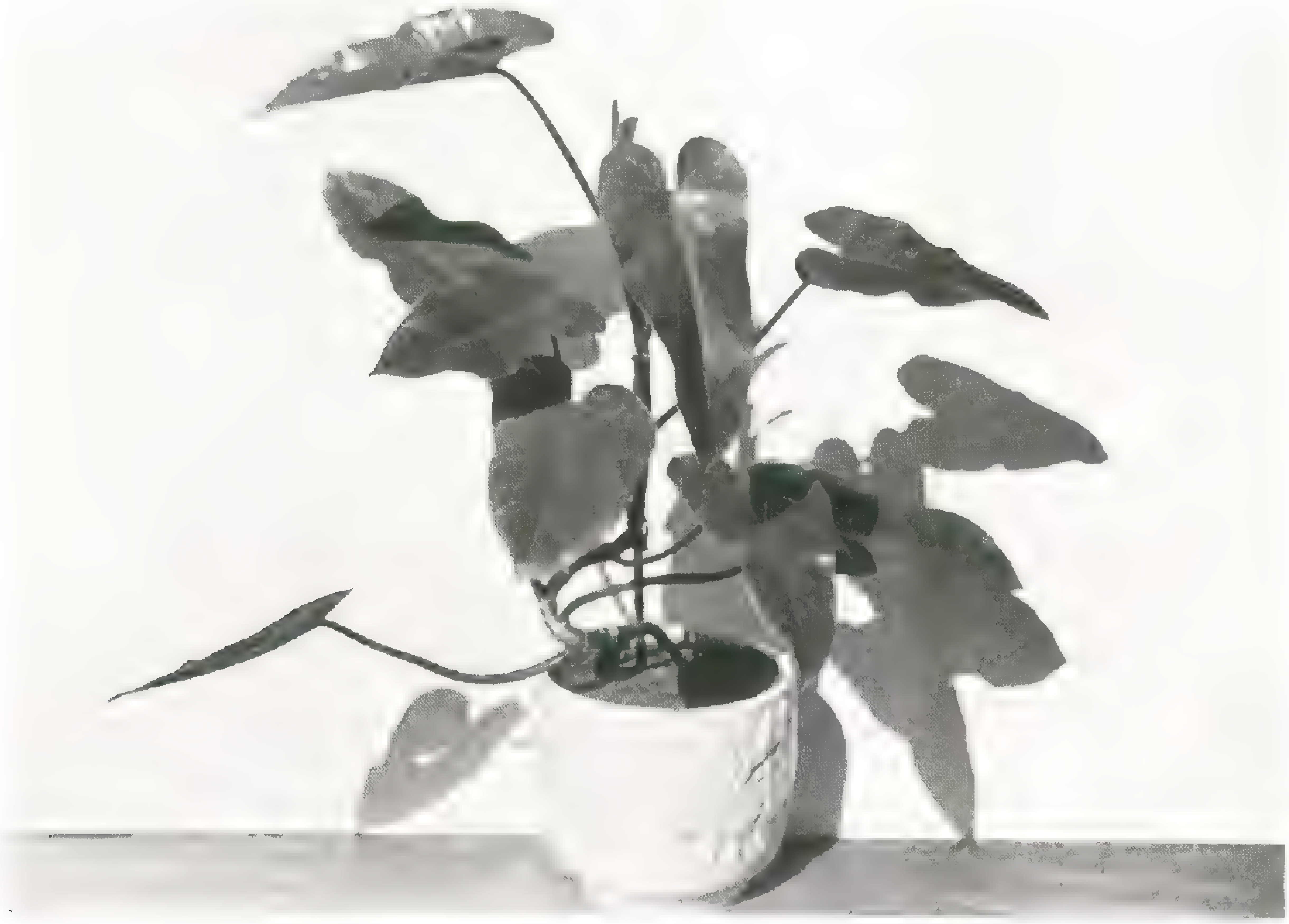
Abutilon (Flowering Maple)
Azaleas—many kinds
Begonias—many kinds
Beloperone (Shrimp Plant)
Bulbs—tender and hardy kinds forced
Callas—white-flowered and yellow-flowered types
Coleus—many kinds
Crotons—many kinds
Cuphea (Cigar Plant)
Fuchsias—many kinds



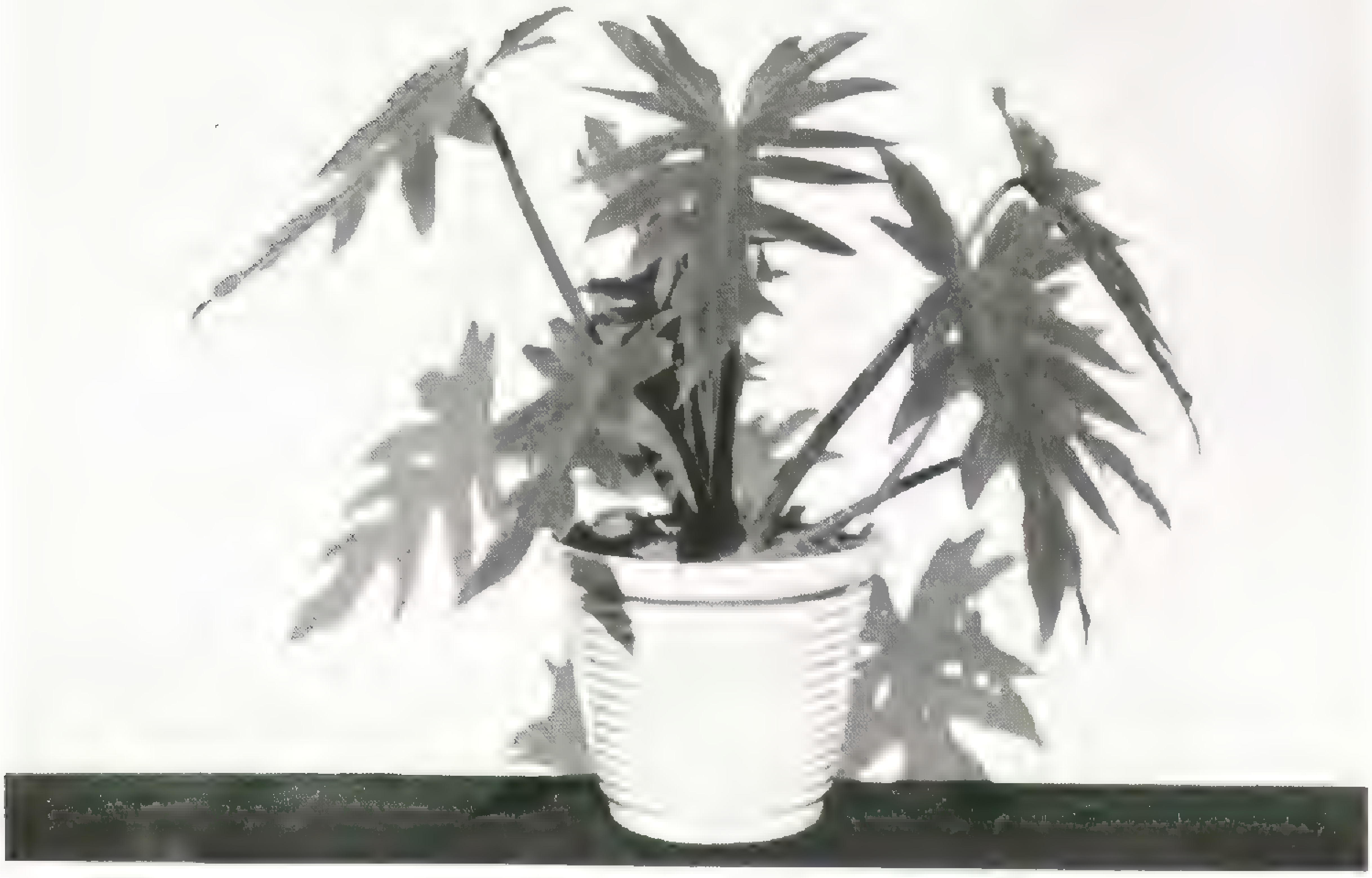
Aechmaea Weilbachii, an unusually good house plant. Rare.



Billbergia pyramidalis (Torch Plant), with its striking orange-red flower spike, is an outstanding novelty.



Philodendron erubescens. Very desirable.



Philodendron dubium, a rare novelty.

- Geraniums—many kinds including the scented types
- Heliotrope
- Impatiens (Touch-me-not)
- Lantana (Weeping Lantana)
- Pilea (Artillery Plant)
- *Plumbago capensis* (Leadwort)
- Seasonal florists' plants listed in Group 1
- Trailing plants listed in Group 4

SHADY EXPOSURE

- Aglaonema (Chinese Evergreen)
- Aspidistra (Cast-iron Plant)
- *Begonia Rex-cultorum* (Rex Begonia)
- Caladium—many kinds
- Cordyline (Fountain Plant)
- Cycas (Sago Palm)
- Dieffenbachia (Dumb Cane)—several kinds
- Dracaena (Corn Plant)—several kinds
- Ferns—many kinds
- *Ficus elastica* (Rubber Plant)—several other kinds of Ficus
- Grevillea (Silk Oak)
- Palms—several kinds
- Sansevieria (Mother-in-law's Tongue)—several kinds
- Trailing plants:
  - Cissus (Grape Ivy)
  - *Hedera Helix* (English Ivy)—many horticultural forms
  - Nephthytis
  - Philodendron
  - Scindapsus (Pothos)
  - *Senecio mikanioides* (German Ivy)
  - Tradescantia (Wandering Jew)—several kinds

Of course these plants can be raised in sunny exposures as well as in shade. In fact, most of them grow better if they have a bit of direct sunlight each day.

9. Plants for Outdoor Window-boxes.—

SUMMER

Sun

- Acalypha (Copper-leaf)
- Ageratum (Floss Flower)
- Asparagus Fern
- Beloperone (Shrimp Plant)
- Coleus
- Cordyline (Fountain Plant)
- Crotons
- Geraniums—flowering & scented
- Heliotrope
- Lantanas
- Marigold—dwarf types
- Nasturtium—single & double
- Pandanus (Screw-pine)
- Peristrophe
- Petunias
- Santolina (Lavender-cotton)
- Senecio (Dusty Miller)
- Snapdragons (dwarf varieties)
- Strobilanthes
- Verbenas
- Vinca (Variegated Periwinkle)
- Also the trailing plants listed in Group 4

Shade

All of the plants listed in Group 8 for shady exposure can be used outdoors for boxes that receive little or no direct sun. The following plants are also good:

- Fuchsias
- Impatiens
- Variegated Vinca

WINTER

Use dwarf specimens of various evergreens such as Boxwood, Cedar, Juniper, Spruce and Yew.

10. Plants for Wardian Cases.—

- *Aglaonema costatum*
- *Begonia Rex-cultorum* — small varieties
- Cacti and Succulents — many kinds; avoid over-watering.
- *Cissus striata* (Dwarf Grape Ivy)
- *Dracaena Godseffiana*
- *Dracaena Sanderiana*
- *Euonymus Fortunei* (Creeping Euonymus)
- *Ficus pumila* (Creeping Fig)
- Fittonia—several kinds
- *Hedera Helix* (English Ivy)—dwarf horticultural varieties
- Helxine (Baby Tears)
- Maranta—several kinds
- Peperomia—several kinds
- Pilea (Artillery Plant)
- Philodendron—small specimens
- Primula—several kinds
- Saintpaulia (African Violet)
- *Saxifraga sarmentosa* (Strawberry Geranium)
- Scindapsus (Pothos) — small plants
- Tradescantia (Wandering Jew)
- *Zebrina pendula* (Purple Wandering Jew)
- Ferns:
  - Adiantum (Maidenhair Fern) —several kinds
  - Native or Wild Ferns—many kinds
  - Nephrolepis (Boston Fern)-several varieties
  - Pteris (Brake Ferns)—several kinds

Dwarf specimens of almost any kind of plant, can be raised in Wardian Cases.

11. Plants for Conservatories.—In a conservatory where there is sufficient sunlight, abundant moisture and moderate temperature, it is possible to raise certain plants that would not thrive with average treatment in the house. Here are a few of them.

- *Acalypha hispida* (Chenille Plant)
- Alocasia—several kinds
- Anthurium—several kinds
- *Calathea variegata* (pl. 57)
- Camelia
- *Cibotium Schiedei* (Tree Fern)
- *Cytisus canariensis* (Genista)
- Gardenia
- Jacobinia
- Jasmine
- *Musa nana* (Dwarf Banana)
- Orchid—many kinds

12. Herbs.—These plants have conspicuous odors and flavors and never fail to create interest. In addition to being fragrantly ornamental they are useful for seasoning food. Young plants started from cuttings taken in late summer make nice-sized specimens for winter use. The old stock plants can be wintered over in the house if desired. Full sun, fertile soil, a fair amount of moisture and a temperature of 65–75° F. are important cultural items.

Allium Schoenoprasum (Chives)
Lavandula (Lavender)
Lippia citriodora (Lemon Verbena)—may be dormant in early winter
Majorana hortensis (Sweet Marjoram)
Mentha (Mint)—several kinds; dormant in early winter
Myrtus (Myrtle)
Ocimum Basilicum (Sweet Basil)
Rosmarinus (Rosemary)
Scented Geraniums:
  Pelargonium crispum (Lemon Geranium)
  Pelargonium graveolens (Rose Geranium)
  Pelargonium odoratissimum (Nutmeg Geranium)
  Pelargonium tomentosum (Peppermint Geranium)

13. Cuttings of Garden Plants.—Some garden plants, raised from cuttings taken in the fall before frost, make a good showing in the house if exposed to full sun.

Coleus—many kinds
Crotons—many kinds
Geraniums — flowering and scented types
Heliotrope
Ivy—several kinds
Lantana—several kinds
Nierembergia caerulea (Cup Flower)
Plumbago capensis (Leadwort)
Salvia splendens (Scarlet Sage)
Sedum—several kinds
Tradescantia (Wandering Jew)
Verbena laciniata (Moss Verbena)—commonly known as *V. erinoides*

14. Garden Annuals Potted up and Brought Indoors before Frost.—Towards fall, a number of young seedlings will usually be found near the annuals that have been blooming during the summer. These seedlings can be potted up and brought into the house where they may bloom for several weeks.

Ageratum (Floss Flower)
Cosmos var. Orange Flare
Marigold
Nasturtium
Petunia
Torenia (Wishbone Flower)
Zinnia

15. Plants to Start from Seed.—Many indoor gardeners have no luck with seed sowing. Invariably, the trouble lies in unsuitable conditions for seed germination and growth of the seedlings. The main cultural items involved have already been discussed under the heading of propagation, so we will not repeat them here.

Sow in late summer or early fall

Grape Fruit—seed saved from breakfast
Marigold (Lieb's Winter-flowering)
Nasturtium
Pansy—sow seed in August, leave in protected cold-frame over winter and have blooming plants in early spring.

Snapdragon—special winter-flowering types
Thunbergia (Black-eyed Susan)

Sow in late winter for spring bloom

Most annuals, if started early enough, will produce a few flowers in the house before the weather permits transferring them to the garden. A conservatory, cool sun-room or at least large windows facing south should be available for this type of gardening. Some of the easiest to flower are:

Ageratum
Balsam
Calendula
Calliopsis
Cosmos
Marigold
Morning-glory
Nasturtium
Petunia
Phlox
Snapdragon
Sweet Alyssum
Verbena
Zinnia

16. Bulbous Plants.—Bulbs are ideal for house decoration and may be forced into flower at various times during winter and spring. Hardy bulbs such as Crocus, Daffodils, Dutch Hyacinths, Grape Hyacinths (Muscari), and Tulips are purchased in the fall, potted up in bulb-pans before freezing weather and placed outdoors in a cold-frame or trench for roots to develop (pl. 65). This storage period is essential because the bulbs will not flower properly without sufficient root growth. A sandy loam soil, abundant moisture at all times and cool temperature (45°–60° F.) are important cultural items. Complete details on how to force hardy bulbs will be found in the September, 1939, issue of the Garden BULLETIN.

Paper White Narcissus can be flowered in winter with very little effort. About all they require is a bowl of gravel, water and a storage period of two to three weeks in a cool, dark place to make roots. Then put them in a cool, sunny window where the tops will develop and produce flowers. Lack of sufficient sunlight and high temperatures cause them to get tall, weak and floppy. Large-sized Hyacinth bulbs can be flowered in similar fashion, using special forcing glasses for the bulbs instead of bowls.

Lily-of-the-Valley may be flowered at any time during the year. Ordinarily, the forcing "pips" are available at seed stores, but at present, due to the mad scramble taking place in Europe, the supply has been cut off. When this smoke of insanity clears away and Lily-of-the-Valley "pips" are again on the market, here is

Arrangement of bulb pots in cold-frame. Note the peat-sand mulch on the pots in the background, also the sash covers on the cold-frame.

This is what the bulbs look like in February when the mulch is removed.

the way to force them into flower. Pot them up in a mixture of half sand-half peat and place in total darkness for ten days at a temperature of 80° F., with abundant moisture at all times. The tops grow rapidly and are yellow in color. At the end of the ten-day storage period the pots are brought out into full sunlight where the tops soon turn bright green and flowers become fully developed within a week to ten days. After the plants are through blooming, they are of no further value as all their strength has been expended producing flowers out of season. Clumps taken from the garden will not force this way.

Other bulbous plants for winter, spring and summer display are: Achimenes, Agapanthus (Lily-of-the-Nile), Amaryllis, Anemone, Begonia (tuberous type), Calla, Clivia (Kafir Lily), Colchicum (Autumn Crocus), Freesia, Gladiolus, Gloxinia, Hymenocallis (Spider Lily), Ixia, Ornithogalum, Oxalis and Ranunculus (Double Persian Buttercup). All of these are more or less tender (not hardy) plants that require no special storage in a cool, dark place to establish roots. Just pot them up in fertile soil, expose to full sun, keep well watered and fairly cool (60°–70° F.).

GIFT PLANTS

What to do with the Christmas Poinsettia, Easter Lily, Mother's Day Hydrangea, etc., after they are through flowering, is quite an important problem for many who receive these delightful gifts. Are they worth saving, and if so, how? The answers, of course, depend to a great extent on how well the home is equipped to take care of the plants. With a small greenhouse, conservatory, or cool sun-room it is entirely possible to salvage nearly all these plants. In an apartment it is practically impossible to save any of them. Generally speaking, the treatment of gift plants may be summarized as follows:

1. Discard after Flowering.

Begonia (Cincinnati, Lady Mac, Marjorie Gibbs, Melior and other "semi-tuberous" florists' varieties)
Calceolaria (Lady's Pocketbook)
Calendula (Pot Marigold)
Christmas Pepper (Capsicum)
Cineraria
Cyclamen
Jerusalem Cherry (Solanum)
Lily-of-the-Valley (Convallaria)
Marguerite Daisy (Chrysanthemum)
Schizanthus (Poor-man's Orchid

2. Give Rest-period after Flowering.

Gradually withhold water until the soil is completely dry; the plant sheds all its leaves and becomes dormant, but not dead. Store dormant plants in a cool, dry place until their rest period is over.

Poinsettias—Rest period over in early spring. Bring plants out into full sunlight and start watering. Make cuttings from new growth. Old plants make interesting garden subjects and grow rapidly in semi-shade. Rooted cuttings are potted in fertile soil, placed in a protected spot in the garden, brought indoors before frost and "flowered" at Christmas time. For complete information on how to handle Poinsettias, refer to the December, 1938, issue of the Garden BULLETIN.

Callas—Dormant during summer and usually begin sprouting about September. Repot "bulbs" in fertile soil and bring indoors. Callas like full sun, a warm temperature and lots of water. Flowers appear in late winter or early spring.

Fuchsia—Plants which flower vigorously in spring should be given a rest during summer. Store them in a cool, dry place with not much sun and just enough water to keep the stems from shrivelling. Growth starts again in fall. Then repot in fertile soil, water and give the plants full sun, but not too much heat. Cuttings can be made from the new growth.

3. Move Outdoors in Partial Shade.

Keep plants growing and move them to a protected spot in the garden. Bury pots to the rims in soil. If no garden space is available, put the plants on the terrace or porch where they will have fresh air, rain and some protection from the burning sun. Bring them indoors before frost.

Amaryllis—Repot in fertile soil immediately after flowering. Rest period varies, but when the leaves start to turn yellow in summer or fall, let the soil dry out. Bring them indoors before frost and store in a cool, fairly dry place. When new growth starts to appear, put the pots in full sun and begin watering. Flowers are produced in winter and spring.

Azaleas—Do not repot. The plants require part shade in the garden and frequent watering during spells of dry weather. Bring indoors before frost, and grow them in a cool, sunny place. Flowers appear in late winter and early spring. Plants may need repotting the second year after flowering. They require an acid soil.

Begonias—The fibrous rooted or ever-blooming types do well outside in partial shade. Repot in fresh soil and bring in before frost. Vigorous specimens can be pruned back to a desirable size.

Gardenias—Treatment same as for Azaleas.

Geraniums—Leave plants in pots sunk in the ground or placed in porch boxes. They enjoy quite a bit of sun and not too much water. Repot in early fall, prune back the tops to make the plants bushy and bring in before frost. No rest period necessary.

4. Planted Permanently in the Garden.—In spring when the weather permits, the following plants are removed from the pots and set out in the garden or shrub border where they may recuperate in a year or two if provided with fertile soil and not entirely neglected.

Astilbe—likes a cool, moist spot with not too much direct sun.
Bleeding-heart—requirements same as for Astilbe.
Bulbs—Daffodils, Tulips, Hyacinths and other hardy bulbs that have been "forced" in the greenhouse often flower for several years if planted in the garden. Easter Lilies need a protective mulch in cold climates. Do not plant tropical bulbs outdoors.
Chrysanthemums—bush types are particularly good; they require full sun to grow well.
Hydrangea—needs a protective mulch in cold climates; does fine in part shade.
Rose—full sun, fertile acid soil and good drainage.

Well, that is all for the present. Essential details of culture have been discussed and over 150 different kinds of house plants listed. Somehow it occurs to me this should be enough—at least for a good start. Information as to where most of these plants can be obtained will be furnished by the writer on receipt of a self-addressed stamped envelope.

D. C. F.

NOTES

Dr. David C. Fairburn, Horticulturist to the Garden, gave a lecture on "House Plants," illustrated with colored slides, before the St. Louis Horticultural Society, December 5.

Mr. Paul A. Kohl, Floriculturist to the Garden, gave a talk on "The Missouri Botanical Garden," illustrated with moving-pictures, at a joint meeting of the University City Garden Club and the University City Women's Chamber of Commerce, November 13.

Dr. George T. Moore, Director of the Garden, gave a lecture, "The Missouri Botanical Garden as a Scientific Institution," before the Biology Division of the University of Illinois, at Urbana, December 11.

A description and an illustration of the "Veiled Prophet's Queen's Bouquet 1941," by Mr. George H. Pring, Superintendent of the Garden, appears in the November number of the *American Orchid Society Bulletin* (**10**:59).

Mr. George H. Pring, Superintendent of the Garden, spoke at the Sunday Breakfast Club of the Downtown Y. M. C. A., November 23, on "The Missouri Botanical Garden," after which a cavalcade of cars carried the "breakfasteers" to visit the chrysanthemum show at the Garden.

Mr. Ladislaus Cutak, in charge of Succulents at the Garden, gave an illustrated talk before the Garden Club of St. Louis, November 18, on "A Cactus Hunt in Old Mexico"; and one before the St. Louis Nature Study Society, November 25, entitled "Adventures in Cactus Land."

Recent visitors to the Garden include Dr. K. S. Chester, head department of botany, Oklahoma Agricultural & Mechanical College, Stillwater; Dr. G. W. Martin, professor of botany, University of Iowa, Iowa City; Dr. E. R. Spencer, professor of botany, McKendree College, Lebanon, Ill.; Mr. Leslie Lee, graduate student in botany, Wabash College, Crawfordsville, Indiana.

The fourth number of Volume 28 of the ANNALS OF THE MISSOURI BOTANICAL GARDEN was issued in November, with contents as follows: *"Dichophyllum Moorei* and Certain Associated Seeds," by Henry N. Andrews; "A Revision of the North American Species of the Genus Anisacanthus," by Stanley H. Hagen; "Contributions toward a Flora of Panama. V." by Robert E. Woodson Jr. and Robert W. Schery; The Cytogenetics of *Poa pratensis,"* by William L. Brown.

Members of the Soil Conservation Service who visited the Garden Arboretum October 28 were: Mr. Thor K. Bergh, Nursery Manager Soil Conservation Nursery, Winona, Minn.; Mr. C. J. Coukos, Assistant Agronomist, and Mr. Hugh A. Steavenson, S.C.N., Elsberry, Mo.; Mr. L. M. Dickerson, Chief, Regional Biology Division, Soil Conservation Service, Dayton, Ohio; Mr.

Albert F. Dodge, Regional Woody Plant Technician, S.C.N., Ames, Iowa; Mr. Harry A. Gunning, Chief, Nursery Division, S.C.S., Washington, D. C.; Dr. August E. Miller, Chief, Regional Nursery Division, S.C.S., Dayton, Ohio; Mr. John W. Sites, Regional Observation Nurseryman, S.C.S., Gainesville, Ohio; Mr. A. D. Slavin, Chief, Regional Nursery Division, S.C.S., Milwaukee, Wis.; Dr. William R. Van Dersal, Assistant Chief, Biology Division, S.C.S. Washington, D. C.

STATISTICAL INFORMATION FOR NOVEMBER, 1941

GARDEN ATTENDANCE:	
Total number of visitors	37,361
PLANT ACCESSIONS:	
Total number of plants and seed packets received as gifts	1,133
LIBRARY ACCESSIONS:	
Total number of books bought	3
Total number of books and pamphlets donated	21
HERBARIUM ACCESSIONS:	
By Purchase—	
Cronquist, Arthur—Plants of Idaho	600
By Gift—	
Anderson, Edgar—Plants of Illinois	3
Berry, E. C.—Hepaticae of Illinois	3
Core, Earl E.—*Tripsacum dactyloides* L. of West Virginia	1
Ek, Charles M.—Plants of Indiana	5
Finfrock, Christopher—*Polyporus* sp. from Missouri	1
Hawk, H. A.—Plants of Oklahoma	15
James, Leslie—Plants of Alabama	6
Ownbey, Gerald B.—Plants of Wyoming	16
Pinkus, L. F.—Fern from Meramec Cavern, Missouri	1
Stanford, L. R. and K. L. Retherford—Plants of Mexico	3
von Schrenk, Hermann—*Taxodium* from Florida	6
By Exchange-	
Gilbert, Frank A.—Plants of West Virginia	43
Museo Nacional de Historia Natural, Santiago de Chile—Plants of Chile	150
New York State College of Agriculture, Cornell University, by W. C. Muenscher—Plants of western and southern United States	100
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